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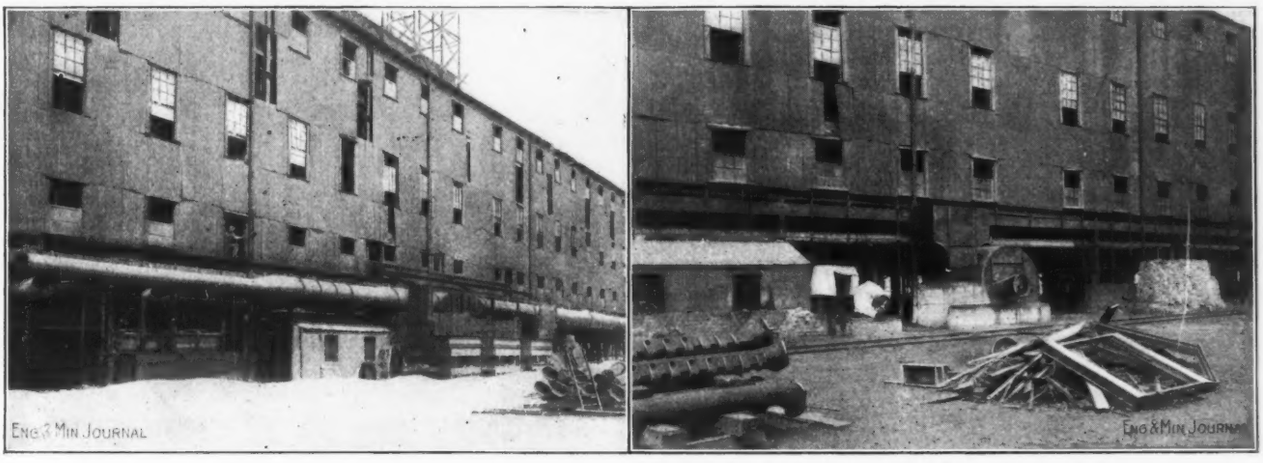
Roasting at Steptoe Valley Smelting Works

By S. S. Sörensen*

SYNOPSIS—A description of the improvements by which the McDougall roasters at the Steptoe plant were brought from 50 to 100 tons daily capacity.

The roasting plant of the Steptoe Valley Smelting & Mining Co. consists of sixteen 18-ft. six-deck McDougall furnaces of Allis-Chalmers standard design and make. They were supplied with coal-fired fireboxes, placed on the ground floor and connected by a brick flue to an opening on the bottom hearth. They had water-cooled center columns and arms on the system of one of F. Klepetko's numerous designs and patents. The plant was run at first on two classes of concentrates, one from the Veteran mine of the Cumberland-Ely company and the other from the Eureka pit of the Nevada Consolidated company. The Veteran concentrates ran about Cu, 9.4%; SiO_2, 26.8; Fe, 28.8; Al_2O_3, 3.6; S, 28.0%; and the Nevada Consolidated concentrates about Cu, 16.85%; SiO_2, 29.7; Fe, 21.8; Al_2O_3, 4.0; S, 26.5. These were produced in about equal amounts which gave an average of about Cu, 13.1%; SiO_2, 28.2; Fe, 25.3; Al_2O_3, 3.8; S, 27.2%.



Steptoe Valley Smelting Works, Roaster Blast Main, Fan in Center of Building

Water Cooling Cut Out to Save Heat

This required roasting for a 45% matte, to about 8% S in calcines or 70.5% elimination of S. Under these conditions there was enough heat generated to make them almost self-roasting. The fireboxes were mostly used for starting up and the water cooling was beneficial and even necessary when on Veteran concentrates alone. At times when Veteran concentrates were not roasted, all concentrates were from Copper Flat ore. The sulphur content was reduced and with the higher tenor in copper the elimination had to be less. Consequently auxiliary firing had to be adopted. On the suggestion of W. M. Barker who was at the time master mechanic at the smelting plant, the plan of saving heat by cutting out the water circulation and substituting air for that purpose, as had been the practice at Campo Seco in California, was tried.

He drilled several 2-in. holes in that part of the center column which projected below the bottom of the furnace, to allow air to enter the hollow space in the columns which had been used for the pipes and the water circulation. He also drilled holes in the ends of the hollow arms in the three lower hearths. This allowed the stack draft to pull air up through the center column and out through the arms. Then he tried a small air jet blowing into a wind box surrounding the projecting end of the center column, where the holes were, to force more air in than the light draft from the stack would induce. The results were encouraging. But we feared that the cost of repairs might overbalance the cost of fuel saved. The concentrates as fed to the roasters carried about 10% moisture, and heat in addition to that from roasting had to be supplied. This was done by shoveling coal as required into the third hearth. This system was tenta-

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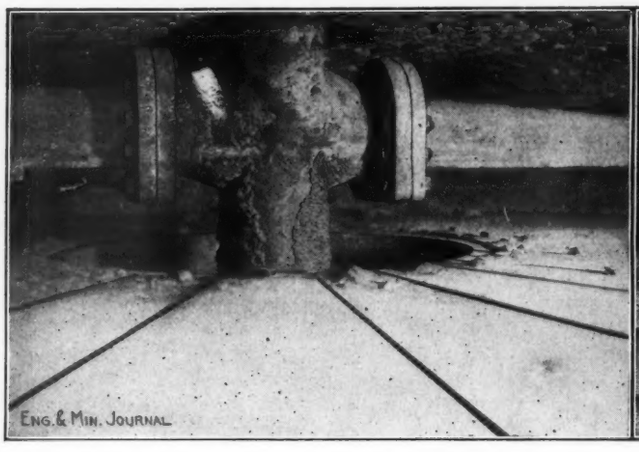
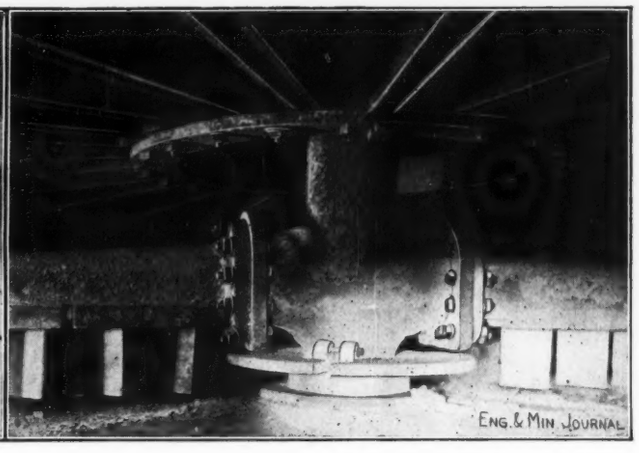
tively and slowly substituted for water cooling till we saw that the repairs were not going to outweigh the heat saving and increase of tonnage obtained. Our next step was to put a small fan to provide forced blast of two or three inches of water not only for better cooling of center columns and arms but by blowing down on the charge to promote more active oxidation. The evidence of this activity is visible in the extra flame or extra glow from the calcines where the air impinges. Finally a big fan of about 25,000 cu.ft. capacity at 3½-in. pressure was put in to supply all the furnaces.

When oil was substituted for coal at our reverberatories we soon followed suit at the roasters. This made firing and the regulation of firing easy and enabled us, by forcing the firing, to counteract the high percentage of moisture. Our tonnage per furnace per day was increased by these improvements from 50 tons to about 90 tons. The next step was to build the floor of the first hearth of cast iron, which has given an increase in capacity to over 100 tons per furnace day. We are now putting on two extra hearths in order to get an open-top drying floor similar to those adopted by Wedge and Herreshoff. This is not only to increase the capacity of the furnace but to keep a large part of the moisture out of the flue gases, which have proved so destructive that we are now building a new roaster stack.



STEPTOE ROASTERS, CAST-IRON HEARTH, TOP VIEW



CAST-IRON HEARTH FROM UNDER SIDE

Pyrites Co.'s Plant

A plant for the treatment of iron pyrites to render it suitable for blast-furnace use, is being built at Roanoke, Va., by the Pyrites Co., Ltd. (*Iron Trade Review*, June, 12, 1913), and operations will be inaugurated within the next few weeks. The company building the plant is associated with the interests controlling the Rio Tinto mines of Spain, as noted in the JOURNAL of June 20, 1912, which ship iron pyrites to this country in large quantities, principally to manufacturers of sulphuric acid. After the ore has been used by these acid manufacturers and the sulphur obtained, the residue is to be collected at the new Norfolk plant, where the copper will be removed and the material sintered for the reclamation of the iron. The sintering of the ore will be carried out in a unit of the Dwight & Lloyd type, which will be of 150-ton size. Since the pyrites ore contains 60% or over of iron, and the sintered product will be about 0.02% in phosphorus, it is believed that this material will be attractive to blast furnaces, particularly in the Virginia and Southern districts. If the present plant proves a commercial success, its capacity will be enlarged.

Workmen's Compensation and Employer's Insurance in California

The workmen's compensation, insurance and safety act passed by the California legislature May 9, 1913, creates an industrial accident commission, composed of three members to be appointed by the governor, from the state at large, within 30 days from Jan. 1, 1914. If signed by the governor the bill will become a law and enforced on and after that date. The act creates also a state compensation insurance fund, to be administered by the industrial-accident commission. An appropriation of $187,470 is provided for carrying out the provisions of the act. The act applies to mines and mining plants as well as to other industries. There is created a liability on the part of employers to compensate employees and their dependents for accidental injury or death, irrespective of the fault of either party. The act requires safety in all employment and places of employment; requires reports of industrial accidents; provides for the enforcing of its provisions and penalties for offenses by employers and their officers and agents and employees.

The liability for compensation is without regard to negligence on the part of the employee, provided it is not caused by intoxication or willful misconduct. The compensation includes medical, surgical and hospital treatment. If the accident caused disability the indemnity shall be payable in advance on the fifteenth day after the injured employee leaves work as a result of the injury, and thereafter not less frequently than twice each calendar month unless otherwise ordered by the commission. If the period of disability does not result longer than two weeks no indemnity shall be recoverable. If the period is longer than two weeks, there is no indemnity for the first two weeks of the disability. Indemnity for disability is payable as follows: For total disability, 65% of the average weekly earnings; for partial disability, 65% of the weekly loss in wages. The aggregate indemnity for a single injury causing temporary disability shall not exceed three times the average

annual earnings of the employee and the period not to exceed 240 weeks from the date of the accident. If the accident causes permanent disability the percentage of disability shall be determined, and the indemnity computed on the basis of 65% of the average weekly earnings for periods graduating from 40 weeks for a 10% disability to 240 weeks for a 60% disability. Disabilities of 70, 80, 90 and 100% are based on the 240-week period with an additional percentage of the weekly earnings ranging from 10% to 40%, for the remainder of the life of the disabled employee.

There is also provided indemnity for permanent disabilities intermediate to those above mentioned, based upon 65% of the average weekly earnings and varying in periods according to the percentage of disability. If the accident causes death, either with or without disability, the death benefit shall be payable on a basis of 65% of the average weekly earnings as follows: In case the deceased employee leaves a person or persons wholly dependent, the total death benefit and disability indemnity should be equal to three times the annual earnings, the annual earnings to be taken at not less than $333.33 nor more than $1666.66. In case the deceased employee leaves no person wholly dependent, but one or more persons partly dependent, the death benefit is provided on the basis of percentage of the annual amount devoted by the deceased employee to the support of such dependents. If no dependent is left, the death benefit shall be for burial services not exceeding the cost of $100, and such other death benefits as may be provided by law.

Proceedings for the collection of indemnity must be commenced within six months and for collections of death benefits within one year. If incapacity from accident is not proved to have resulted the commission may, instead of dismissing the application, award nominal indemnity if it appears that disability is likely to result at a future time. At the time of making the award or any time thereafter the commission on its own motion may commute the compensation to a lump sum, if it appears to be necessary for the protection of the person entitled to it or for the best interest of either party.

Nothing in this act shall affect the organization of any mutual or other insurance company or any existing contract for insurance against liability for the compensation provided for by this act. Liability for compensation shall not be reduced or affected by any insurance, contribution, or other benefits due to or received by the person entitled to such compensation, except under certain provisions. Contracts made by the employer for insurance against liability for compensation must show that the insurance carrier shall be directly and primarily liable. Such policy shall also provide that the employee shall have a first lien upon any amount which shall become owing on account of such policy to the employer from the insurance carrier, but in case of legal incapacity or inability of the employer to receive the amount and pay it over, the insurance carrier shall pay the same directly to the employee or his dependents.

The compensation-insurance fund created and established by this act is without liability on the part of the state beyond the amount of the fund. The purpose is to insure employers against liability for compensation under this act, and to insure to employees and other persons the compensation fixed by the act. It shall be a revolving fund to consist of such specific appropriations as the legislature may from time to time make or set aside for its use, and all premiums received for compensation insurance issued, and also all moneys belonging to the fund and all interest earned. The fund shall be applicable to the payment of losses sustained on account of insurance and to the payment of salaries and other expenses. In the name of the state-compensation insurance fund, the commission may sue and be sued in all the courts of the state; may make and enter into obligations relating to the fund; may invest and reinvest the money belonging to the fund; and conduct all business and affairs in relation thereto whether specifically designated by the act or in addition thereto. The manager of the fund may enter into contract of insurance, insuring both employers and employees in the matter of compensation; may sell annuities covering compensation benefits; may decline to insure any risk in which the minimum requirements of the commission with regard to construction, equipment and operation, are not observed or any risk which is beyond the safe carrying of the fund; may reinsure any risk or any part thereof; may inspect and audit the payrolls of employers applying for insurance; and make rules for settlements of claims against the fund; and contracts with physicians, surgeons and hospitals for treatment and care of injured persons entitled to benefit from the fund. The commission shall fix the rates to be charged for insurance determined upon such percentage of the payroll of an employer which, on the average, shall produce a sufficient sum when invested at 3½% interest. The insurance contracts may be either limited or unlimited. The treasurer of the state shall be the custodian of all the money and securities belonging to the fund except as otherwise provided.

Counties, cities, school districts or other public corporations within the state may insure against liability for a compensation with this fund, and not with any other insurance carrier unless this fund shall refuse to accept the risk.

Every employer shall, under this act, furnish employment which shall be safe for the employees, and places of employment which shall be safe, and shall furnish and use safety devices and safeguards, and adopt and use such practices, means, methods, operations and processes as are reasonably adequate. No employer shall require or permit an employee to be employed in a place which is not safe, nor construct any place of employment that is not safe. The commission is vested with full power and jurisdiction and shall have supervision over every employment and place of employment as may be necessary to adequately enforce all laws regarding safety and the protection of life. The commission shall have power to prescribe safety devices or methods of protection and fix reasonable standards and modify and enforce reasonable orders for the installation and operation of means or methods of protection, and order reasonable standards for construction, repair and maintenance of safe places of employment. The time and place for holding a hearing for the purpose of issuing general safety orders shall be advertised in daily newspapers in San Francisco and Los Angeles.

This act does not deprive boards of supervisors or trustees or other public corporations of any power or jurisdiction over places of employment; but a standard of safety fixed by the commission shall be construed in connection with any local order relative to the same mat-

ter. The commission shall have power to establish and maintain museums of safety and hygiene, in which shall be exhibited safety devices and other methods for protection of life and safety of employees, and to publish and distribute bulletins; to cause lectures to be delivered and illustrated for the information of the employer and employees and the general public, in regard to cause and prevention of accidents. The commission shall have power to appoint advisers, without compensation, to assist in establishing standards of safety. The secretary, assistant secretary and inspectors appointed by the commission shall have all the powers of peace officers. The commission may try any or all issues in any proceedings before it and may appoint referees. Appeal may be had from the findings of the commission only to the supreme court and court of appeals of the state.

The Panama-Pacific Exposition

Charles E. van Barneveld, chief of the Department of Mines and Metallurgy, has issued a circular letter to the mining engineering papers, of which the following is the main part:

The following brief résumé will give the status of the exposition to date. The foundation for the fourth International Exposition to be held in this country was laid in the raising of an original fund of $17,500,000, which amount was pledged to it by the people of San Francisco before Congress was asked to give it governmental recognition.

In addition to the popular subscription fund, the State of California has appropriated $5,000,000 to aid the exposition, and the City of San Francisco has authorized $5,000,000 worth of bonds for the same purpose. Approximately $5,000,000 more is assured through county tax levies of 6c. on each $100 assessed valuation to raise funds for county displays at the exposition.

Construction work on the exhibit palaces is in full swing and all buildings will be completed by the end of June, 1914. The organization of the Division of Exhibits is completed, the last department to be organized being Mines and Metallurgy. This exposition will be ready to receive all participants in July, 1914—eight months before the opening day, Feb. 20, 1915. Exhibits of every character from every part of the world may be landed directly at the exposition docks. The same facilities will be offered in the case of railway shipments, which will enable cars to be lightered from the various tidewater terminals of the railroads to the exposition. There will be railroad tracks about the grounds and into the buildings, and large openings will be provided in the buildings to admit the large exhibits.

The exhibits in this exposition will be installed according to a modern classification and according to modern methods. A copy of the official classification and of a pamphlet entitled "Information for Exhibitors" may be obtained by application to the chief of the department.

The natural resources will of course be exhibited by the states of the Union through their several state commissions and by the various nations through their accredited commissions and representatives. It is hoped that each country and state will make a carefully selected exhibit, emphasizing its *distinctive* mineral product, thereby eliminating the usual duplication—the horror of an endless row of cases.

It has been suggested that the exposition of mining operations proper, that is to say prospecting, development and ore extraction, presents some difficulty. It may be said that the science and art of mining is a continuous overcoming of difficulties and we confidently look to the proven ingenuity and resourcefulness of the miner to devise ways and means of illustrating the everyday mining processes. Machinery plays an important part in the operating end of mining and we expect to develop an interesting, instructive exhibit of mining machinery with a reasonable proportion of operative features.

Fortunately we have the metallurgical and manufacturing side to draw on for operating exhibits. Plans are under way for working exhibits in copper smelting, gold milling and the manufacture of niter. Metallurgical processes, the production and manufacture of cement and clay, gem cutting, the production of crude oil and the manufacture of its derivatives and byproducts furnish a large and interesting field for exhibitors.

Baldwin-Westinghouse Locomotive at Timber Butte Concentrator

The Timber Butte Milling Co., Butte, Mont., has recently put into service a 40-ton Baldwin-Westinghouse electric locomotive, to haul material to the concentrator site, and as soon as the concentrator is in operation, the locomotive will haul the concentrate to points on Montana

BALDWIN-WESTINGHOUSE LOCOMOTIVE AT TIMBER BUTTE

St., where switching connections have been established with the different railroads.

The mechanical parts of this locomotive were built by the Baldwin Locomotive Works, Philadelphia, Penn. The electrical equipment is of the latest type for this class of service, consisting of four 90-hp., 500-volt, commutating-pole motors especially designed to give good commutation to all loads found in normal service, and a unit switch-control system, and was furnished by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pennsylvania.

The Peruvian Petroleum Output in 1912 is stated to have been 214,947 tons ("Daily Consular and Trade Reports," May 22, 1913). The wells are shallow and the flow irregular, and the British minister at Lima says that there may be a swing of 50% either way in 1913.

Aluminum Precipitation at Deloro, Ontario

By S. F. Kirkpatrick*

SYNOPSIS—A description of the first commercial application of aluminum dust for precipitating silver from cyanide solutions. It was used at the Deloro works, when cyanide solutions were used to recover silver from extremely high-grade ore and speiss. The need for violent agitation to submerge the aluminum dust was demonstrated and success followed. The free use of patents secured on parts of the process is offered.

In the Journal of May 10, 1913, E. M. Hamilton discussed, in an interesting paper, the use of aluminum as a precipitant of silver at the Nipissing mill in Cobalt. I have read the paper with much pleasure, as for several years I have advocated the use of this precipitant for these silver ores, if for no others.

It may not be generally known that up to the present, excluding the Nipissing bullion, over 14,000,000 oz. of silver have been precipitated by aluminum from cyanide solutions. Most of this has been recovered by the Deloro Mining & Reduction Co. through the cyanidation of Cobalt high-grade ores or speiss produced from these ores, and a minor portion by the O'Brien mill treating low-grade Cobalt ores. A few notes in connection with the commercial development of this process may be of interest.

System Devised through Requirements of Cobalt Ores

In 1906, I undertook some experiments, with the assistance of the Ontario Bureau of Mines, on the ores of the Timiskaming district in order to develop a commercial process of treating them and saving the by-products. Experiments showed that the ores were fairly amenable to cyanidation even when they contained 2000 to 4000 oz. silver per ton, but the cyanide consumption was heavy and zinc was not an ideal precipitant, tending to foul the solutions and give a bullion below market requirements. Considering these questions I was struck with the claims advanced by Moldenhauer, for aluminum as a precipitant. I substantiated these claims and found that the difficulties experienced by the earlier experimenters could be overcome by the use of the metal in the form of dust. The commercial application of the process was introduced by the Deloro Mining & Reduction Co. in 1908, and has been in use ever since.

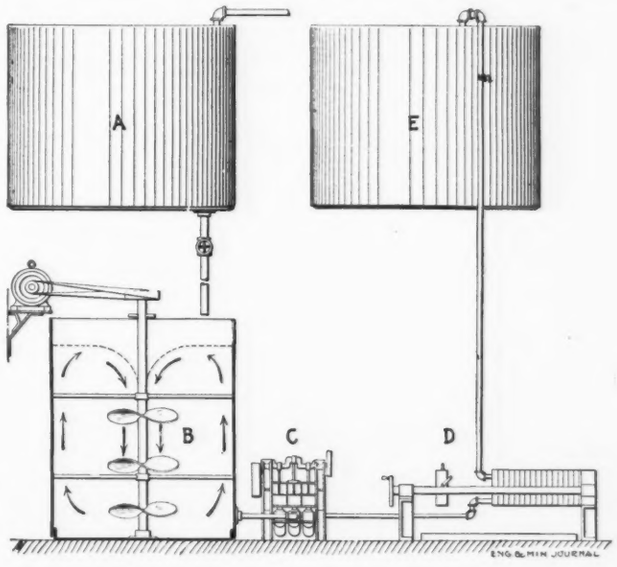
Assay for Silver by Cyanide Regeneration

The solution to be precipitated contains from 25 to 250 oz. silver per ton, varying from day to day. The operation of precipitation is illustrated by the accompanying drawing. From the storage tank *A*, 20 to 30 tons of silver solution are drawn off to the precipitation tank *B*, which is fitted with a set of propellers for agitating the solution and creating a vortex for drawing down the light aluminum powder. To determine the amount of silver in solution, a sample of the solution is taken from the precipitation tank, and titrated for free cyanide, then 100 or 200 c.c. are placed in a bottle and a slight excess of aluminum powder and caustic soda added. The bottle is corked and shaken for one or two minutes, then decanted through a filter and the filtrate titrated for cyanide.

The gain in cyanide (the difference between titration before and after precipitation) is directly proportional to the silver present as there is a theoretical regeneration of sodium cyanide according to the equation of Roessler,

$$6\ NaAgCy_2 + 6\ NaOH + Al_2 = 6\ Ag + 12\ NaCy + 2\ Al(OH)_3$$

After estimating this regeneration of cyanide, the operator may read from a prepared table the silver equivalent. For instance, a regeneration of 10 lb. of cyanide per ton of solution equals 125 oz. silver per ton. The



Emulsifying Apparatus for Aluminum Dust

silver assays so obtained from day to day agree fairly well with laboratory results.

Precipitation Not in Accordance with Theory

An amount of aluminum dust slightly greater than one-eighth of the weight of silver present is then added with about one-half the weight of caustic soda. These additions do not quite agree with the equation given, in accordance with which one part of aluminum should precipitate twelve parts of silver. The discrepancy might be accounted for by a partial precipitation according to the reactions suggested by Mr. Hamilton for low-grade solution, or by loss due to the action of soda and water on the aluminum, or by incomplete solution of the aluminum due to fine particles being coated with silver. The amount of soda required varies with the acidity of the ore or speiss treated.

One precipitation usually gives from 2000 to 7000 oz. of silver, and after agitating for 10 or 15 min., it is transferred by a three-throw plunger pump *C* to one of two presses *D*, the barren solution passing to storage tank *E*. The silver in the press is water-washed, air-dried and

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discharged into a hopper. It is then melted in a Schwartz furnace after fluxing with approximately 16% borax, 8% sodium nitrate, 4% fluorspar, and 5% sand, the bullion being generally about 999 fine. A copy of a page, taken from the daily precipitation record, at random, is shown in Table I.

TABLE I. PRECIPITATION DATA AT DELORO USING ALUMINUM DUST

Date 1913 Apr.	Tons Solution	I	II	III	IV	V	VI	VII	VIII	IX	X
22	33	5.2	156.6	18.0	18.0	Tr.	12.8	160	5280	620	46
23	32	7.8	145.2	20.1	20.0	1.2	12.3	153.7	4920	300	43
24	33	6.3	123.9	16.4	16.6	Tr.	10.1	126.2	4166.2	280	36
25	32	4.6	175.8	19.8	19.8	0.6	15.2	190.0	6080	420	53
25	32	5.7	114.0	15.7	15.8	0.6	10.0	125.0	4000	380	35
26	32	7.4	160.8	20.2	20.2	Tr.	12.8	160.0	5120	600	45
26	32	6.1	110.4	15.7	15.6	Tr.	9.6	120.0	3840	240	33
28	33	5.5	167.7	18.8	19.9	Nil	13.3	166.2	5486	300	49
28	32	6.1	151.5	19.5	19.5	Nil	13.4	167.5	5360	360	48
29	32	3.6	149.1	16.1	16.3	Nil	12.5	156.2	5000	360	44

Col. I. Free cyanide in pounds per ton of solution before precipitation.
Col. II. Ounces silver in solution before precipitation. This is laboratory result recorded day after precipitation.
Col. III. Titration of cyanide after regenerating with aluminum in bottle. Lb. KCN per ton.
Col. IV. Titration of cyanide after precipitation in tank.
Col. V. Ounces silver in solution after precipitation in tank. This is laboratory results received next day. Trace means ½ oz. or less.
Col. VI. Gain in cyanide by regeneration in bottle test. Difference between column I and III.
Col. VII. Ounces silver in solution before precipitation, deduced from gain in cyanide. N.B. Gain of 1 lb. cyanide = 12.5 oz. silver per ton.
Col. VIII. Total silver contents of tank in ounces found by multiplying tons by ounces silver per ton.
Col. IX. Pounds soda added.
Col. X. Addition of aluminum, approximately one-eighth the weight of silver. Amount required read from prepared table.

Cost of Aluminum Precipitation Low

The production of silver and the consumption of aluminum and caustic soda for the first four months of this year were shown in Table II.

TABLE II. MATERIAL USED IN ALUMINUM PRECIPITATION

1913	Tons Speiss Treated	Oz. Silver Produced	Lb. Soda Used	Lb. Soda per 1000 Oz.	Lb. Aluminum Used	Lb. Aluminum per 1000 Oz
January....	130.0	123,602	4,380	35.4	1289	10.4
February...	151.4	165,701	6,570	39.6	1463	8.8
March.....	160.0	190,046	6,686	35.2	1654	8.7
April.....	169.1	184,359	6,008	32.6	1590	8.6
Total....	610.5	663,708	23,644	35.6	5996	9.1

The figures given for the silver are from the daily precipitation record, and are slightly higher than the bullion shipped for the same period. The bullion shipped from the cyanide department for these months was 643,565 oz. This latter figure does not include slag, absorption of lining of the Schwartz furnace and other material returned to the blast furnace from the melting operation. Estimating from these results the cost of chemicals for precipitating 1000 oz. of silver includes: 35.6 lb. soda at 2c. per lb., $0.712, and 9.1 lb. aluminum at 32c. per lb., $2.91; total, $3.622. The advantages of aluminum precipitation were admirably set forth by Mr. Hamilton, whose extensive experience with such problems lends weight to his opinions.

Use of Patents Offered Gratis

In 1910, I took out patents in Canada, No. 126,468; United States, No. 959,757, and Mexico, No. 10,899, on the apparatus required for precipitating with aluminum dust, viz., a tank with some means of producing a vortex to draw down and drown the aluminum powder. As this powder is light and subject to dusting if violently agitated at the surface of the solution and is not easily drowned, this vortex would seem to me an important item in either an intermittent or continuous precipitation process. When taking out these patents, the company I was associated with had some idea of developing the process commercially, but I may now say that anyone adopting aluminum precipitation is welcome to the use of the vortex system and I will be pleased to see the idea developed.

In conclusion I wish to thank the officials of the Deloro Mining & Reduction Co. for the help given in developing the process, referring particularly to the large share of the work done by S. B. Wright, the present manager.

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Annual Reports, Treadwell Group

The reports for 1912, of the Alaska Treadwell Gold Mining Co., the Alaska-Mexican Gold Mining Co., and the Alaska United Gold Mining Co., are so inter-related as to make them more intelligible if taken together. The Alaska Treadwell for 1912, broke 898,962 tons of ore, and 12,891 tons of waste, sending to the mill 892,038 tons of ore with an assay value of $3.22 per ton, according to the mine assays. Development work during the year included 4332 ft. of drifting, 698 ft. of crosscutting, 2924 ft. of raising, 2276 ft. of intermediate drifting, and 786 ft. of station cutting. In addition to this work, the company did for the 700-ft. claim of the Alaska United company, 595 ft. of drifting, 18 ft. of intermediate drifting, 60 ft. of crosscutting, 451 ft. of raising, 147 ft. of station cutting, and 291 ft. of shaft sinking. Treadwell ore reserves at the end of the year were 5,702,696 tons of ore in place, and 1,275,262 tons of ore broken in the stopes. The ore milled yielded in gold, including base bars, $1,159,401 and 17,397 tons of concentrate, which yielded $1,046,487, making the total returns $2,205,889, or $2.4724 per ton of ore milled.

The cyanide plant, which works on the concentrate of the three companies, treated 33,185 tons, at a cost of $3.128 per ton, extracting 97% of the content. Additions to the plant, costing $19,985, would add $0.60 per ton to the cost of treatment.

The receipts for bullion sales are increased by interest, commercial profits on the various shops, etc., and by sundry adjustments, to the sum of $2,259,817. Deducting operating and construction costs of $1,090,096 leaves a net profit for the year of $1,169,721. Dividends of $650,000 were paid and $621,069 written off for depreciation on property and plant.

The Alaska-Mexican company broke 349,018 tons of ore, and 7285 tons of waste and sent to the mill 233,299 tons of ore with an assay value of $3.62 per ton. Development work for the year included 1050 ft. of drifting, 572 ft. of intermediate drifting, 722 ft. of crosscutting, 632 ft. of raising, and 554 ft. of station cutting. The ore reserves at the end of the year were 575,398 tons of ore in place, and 465,233 tons of broken ore in the stopes. The yield in free gold and base bars from the mill was $307,952, and in addition there was produced 4956 tons of concentrate, yielding $371,169, making total returns for the year of $679,121, or $2.9109 per ton of ore milled. The total receipts are increased by sales of powder and by interest to $681,635. Deducting total operating and construction costs of $371,281, leaves net profits for the year of $310,354. Dividends of $225,000 were paid during the year, and depreciation of property and plant to the extent of $100,760 written off.

The Alaska United Company, in its Ready Bullion mine, broke 239,725 tons of ore, and 6216 tons of waste

and sent to the mill 216,454 tons of ore, assaying $4.05 per ton. Development work on this mine was 627 ft. of drifting, 229 ft. of intermediate drifting, 627 ft. of crosscutting, 418 ft. of raising, 518 ft. of station cutting, and 70 ft. of shaft sinking. Ore reserves at the end of the year were 1,405,394 tons of ore in place, and 316,127 tons of ore broken in the stopes. The mill produced in free gold and base bars $317,970 and 6128 tons of concentrate, which yielded $300,188, the total returns being $618,159, equivalent to $2.858 per ton of ore milled. The total operating and construction accounts were $324,898, leaving net profits for the year on this mine of $293,260. On the 700-ft. claim there was broken 227,542 tons of ore, and 10,245 tons of waste, and there was sent to the mill 234,493 tons of ore assaying $3.19 per ton. This includes a slight amount of work done by the Alaska Treadwell. The total amount of development work, including that previously specified as done by the Alaska Treadwell, was 1504 ft. of drifting, 711 ft. of intermediate drifting, 278 ft. of crosscutting, 1305 ft. of raising, 449 ft. of station cutting, and 291 ft. of shaft sinking. Ore reserves at the end of the year were 885,908 tons of ore in place, and 268,365 tons of ore broken in the stopes.

The mill yielded $288,181 in free gold and base bars, and 4707 tons of concentrate which, when treated, yielded $294,951, the total returns being $577,132, equivalent to $2.4628 per ton of ore milled. From these total receipts after deducting construction and operation costs of $324,765, there was left a net profit for the year on the claim of $252,368. Dividends of $324,360 were paid by the Alaska United and $222,522 was written off as depreciation on property and plants.

In connection with the operation of filling underground stopes with mill tailing, an experimental plant has been built and equipped to determine whether it is possible to extract at a profit part of the gold in the tailing. Additions and improvements were made during the year to the assay office, the Treadwell Club and the fire department. A system for supplying salt water to two of the mills is in operation and is also connected with the fire system. The new central hoisting and crushing plant has been practically completed with the exception of the waste bins on the surface, and the transfer bins underground. The first unit of the hydro-electric power plant on Nugget Creek is completed and now in use.

A committee of safety has been organized for the object of minimizing accidents on the surface and underground. The committee is made up of 15 members, eight appointed by the Alaska Labor Union, and seven by the general superintendent of the group. Every accident is immediately investigated by the subcommittee having charge of the department in which it occurs, and the full report made to the committee, which reports on the subcommittee's findings and recommends measures to prevent repetitions. The committee also appoints an inspector whose sole duty is to report any dangerous condition that he may observe either on the surface or underground, and who may, if he sees fit, stop operations until such changes are made as to render their continuance safe. The committee has formulated a system of sick and accident benefits, which schedule has been adopted and put in force by the Treadwell group. All benefits are paid by the company without any tax or deduction from the pay of its employees.

The Production of Copper in 1912

The production of copper in the United States, Canada, Mexico and Cuba in 1912 and previous years, is given in the following table. Our figures are based uniformly upon reports received from the several producers and represent the smelters' output, which is a different thing either from the mine output or the refinery output. In the case of the Michigan production, however, the smelters are also refiners and their figures for smelting and refining productions are consequently the same. The figures that are now presented are the revision of our preliminary figures, published last January. The alterations, either in total or in details, are insignificant.

SMELTERS' PRODUCTION OF COPPER IN THE UNITED STATES

(In Pounds)

State	1910	1911	1912
Alaska	5,008,171	19,412,000	32,602,000
Arizona	299,606,971	300,578,816	357,952,962
California	45,793,894	36,806,762	31,069,029
Colorado	10,127,012	8,474,848	7,502,000
Idaho	6,216,461	3,745,210	5,964,542
Michigan	221,400,864	216,412,867	231,628,486
Montana	286,242,403	271,963,769	309,247,735
Nevada	63,877,500	65,385,728	82,530,608
New Mexico	3,632,351	1,518,288	27,488,912
Utah	125,042,381	138,336,905	131,673,803
Washington	.....	.....	1,121,109
East and South	18,195,450	19,656,971	18,592,655
Other States	1,106,525	1,564,207	4,396,667
Totals	1,086,249,983	1,083,856,371	1,241,762,508

SMELTERS' PRODUCTION OF COPPER IN NORTH AMERICA

(In Pounds)

Country	1910	1911	1912
United States	1,086,249,983	1,083,856,371	1,241,762,508
Canada	52,492,282	56,370,754	75,425,575
Mexico	137,797,217	136,430,331	162,295,545
Cuba	7,799,764	8,274,563	9,684,934
Totals	1,284,339,246	1,284,932,019	1,489,168,562

REFINERS' PRODUCTION

(In Pounds)

Class	1910	1911	1912
Electrolytic	1,151,624,597	1,156,627,311	1,288,333,298
Lake	221,400,864	216,412,867	231,628,486
Casting	32,193,196	22,977,534	24,777,266
Pig	46,903,463	35,920,626	37,181,237
Totals	1,452,122,120	1,431,938,338	1,581,920,287

SMELTERS' PRODUCTION

(In Pounds)

Source	1910	1911	1912
North American ore	1,284,339,246	1,284,932,019	1,489,168,562
Foreign ore	41,976,733	34,392,091	53,701,307
Scrap	10,962,099	18,529,547	11,949,348
Totals	1,337,278,078	1,337,853,657	1,554,719,217
To foreign refiners	33,855,800	32,413,440	45,735,673
To American refiners	1,303,422,278	1,305,440,217	1,508,983,544
Blister copper imported	146,185,104	146,422,851	144,480,144
Total crude copper	1,449,607,382	1,451,863,068	1,653,463,688

CRUDE AND REFINED PRODUCTION COMPARED (*a*)

(In Pounds)

	1910	1911	1912
Smelters	1,449,607,382	1,451,863,068	1,653,463,688
Refiners	1,452,122,120	1,431,938,338	1,581,920,287

(*a*) Owing to some uncertainty as to the counting of copper regained from scrap, it is unsafe to draw fine deductions from the comparison of figures in this last table.

Our system of collecting the statistics from the smelters of North America enables us to arrive at the totals not only for the United States, but also for Canada, Cuba, Chile, Peru and Mexico. The details of the production in Chile and Peru are given in an accompanying table. Another table gives the production of Japan as communicated to us by our correspondent there.

COPPER PRODUCTION OF PRINCIPAL JAPANESE MINES, 1911 AND 1912

In Tons of 2000 Lb.

Mines	1911	1912
Ashio	8,483	10,530
Kosaka	6,606	8,867
Hitachi	6,243	8,704
Besshi	7,573	8,537
Osarusawa and Komaki	2,172	2,385
Ikuno	1,654	1,884
Furokura	2,014	1,719
Ogoya	1,246	1,540
Arakawa	1,410	1,413
Other mines	20,252	23,299
Totals, short tons	57,653	68,878
Totals, metric tons	52,302	62,486

COPPER PRODUCTION OF CHILE AND PERU, 1912

(In Pounds)

	Chile	Peru
Blister copper to U. S.	8,627,421	43,891,439
Copper in ore to U. S.	27,445,679	11,373,009
Copper to England and France	50,136,800	2,900,000
Sundries, estimated	220,000	220,000
Totals, pounds	86,429,900	58,384,448
Totals, metric tons	39,204	26,483

In computing the world's production of copper, we use our own figures for the United States, Canada, Cuba, Chile, Mexico, Japan and Peru; the official statistics for Russia; and the statistics of Henry R. Merton & Co. for the other countries.

WORLD'S PRODUCTION OF COPPER (*a*)

(In Metric Tons)

Country	1910	1911	1912
United States	492,712	491,634	563,260
Mexico	62,504	61,884	73,617
Canada	23,810	25,570	34,213
Cuba	3,538	3,753	4,393
Australasia	(*b*) 40 962	(*b*) 42,510	(*b*) 47,772
Peru	(*c*) 27,375	28,500	26,483
Chile	38,346	33,088	39,204
Bolivia	3,212	2,950	4,681
Japan	(*c*) 50,703	(*d*) 52,303	(*d*) 62,486
Russia	(*b*) 22,700	(*c*) 25,747	(*c*) 33,550
Germany	(*b*) 25,100	(*b*) 22,363	(*b*) 24,303
Africa	(*b*) 15,400	(*b*) 17,252	(*b*) 16,632
Spain and Portugal	(*b*) 51,100	(*b*) 52,878	(*b*) 59,873
Other countries	(*b*) 24,888	(*b*) 26,423	(*b*) 29,555
Totals	882,351	886,855	1,020,022

(*a*) The statistics in this table are our own compilations, except where specially noted to the contrary. (*b*) As reported by Henry R. Merton & Co. (*c*) As officially reported. (*d*) Privately communicated to us from Japan.

In our issue of Jan. 11, 1913, we reported the world's production of copper as having been 1,004,844 tons in 1912, which now appears to have been about 1½% too low. Aron Hirsch & Sohn, of Halberstadt, has since then reported 1,024,423 metric tons, and Henry R. Merton & Co., of London, 1,020,557 metric tons. Our own revised total is 1,020,022 metric tons.

French Iron and Steel Industry

The production of pig iron in France during 1912, according to the figures collected by the Comité des Forges was, in metric tons:

	1911	1912	Changes
Foundry iron	836,454	825,682	D. 10,772
Forge iron	586,496	568,164	D. 18,332
Bessemer pig	104,265	117,221	I. 13,016
Basic pig	2,777,261	3,304,518	I. 527,317
Miscellaneous	122,113	56,407	D. 65,706
Total	4,426,469	4,871,992	I. 445,523

Foundry iron in 1912 includes 138,173 tons of direct castings. Miscellaneous includes 14,688 tons of special irons and 41,719 tons of spiegeleisen and ferromanganese. The raw material used in the blast furnaces in 1912 included 12,016,358 tons of domestic iron ore, 1,126,626 tons of imported iron ore, 225,296 tons of manganese ore, and 841,279 tons of scrap, cinders, etc. The number of blast furnaces in operation averaged 125, with 23 out of blast.

Steel Ingots

The production of steel ingots in 1912 showed an increase of 397,739 tons, or 10.8% over 1911. The details of production were as follows, in metric tons:

	1911 Tons	1911 %	1912 Tons	1912 %
Acid converter	75,158	2.0	73,917	1.8
Basic converter	2,389,352	64.9	2,664,610	65.4
Acid openhearth	1,185,345	32.2	1,302,462	31.9
Crucible and electric	30,758	0.9	37,363	0.9
Total	3,680,613	100.0	4,078,352	100.0

The total converter steel in 1912 was 2,738,527 tons; total acid steel 1,375,379 tons, and basic 2,604,610 tons. Steel-making works in 1912 sold 1,977,088 tons in half-finished form—1,262,150 tons billets and 714,929 tons blooms—to finishing works not making their own ingots.

Finished Steel

The make of finished steel in 1912 showed a gain over 1911 of 390,315 tons, or 14.9%. Some details of production are given, as follows:

	1911	1912	Changes
Rails	449,818	531,304	I. 81,486
Bars and shapes	1,118,312	969,479	D. 148,833
Sheets and plates	449,294	569,412	I. 120,118
Other rolled products	520,238	819,730	I. 299,492
Forgings	59,038	79,553	I. 20,515
Castings	41,784	59,321	I. 17,537
Totals	2,638,484	3,028,799	I. 390,315

Some changes in classification account for the apparent decrease in bars and shapes, and the gain in other rolled products. The totals of the two items were 1,638,550 tons in 1911, and 1,789,209 in 1912; a gain of 150,659 tons last year.

Tuolumne Copper Mining Co.

The report of the directors of the Tuolumne Copper Mining Co. for the year ended Dec. 31, 1912, shows cash on hand, Jan. 1, 1912, $65,344.78; the receipts for copper, silver, etc., are $415,528.55, and receipts for interest, $3129.01.

Disbursements were, for mining and development, $187,476.68; equipment, construction, etc., $17,109.78; lumber, mining timber, and miscellaneous supplies, $46,155.25; fuel, water, light, etc., $19,389.24; office rent, telephone, books and stationery, $2913.09; insurance and taxes, $3826.58; expense, legal and special, $4379.22. Cash on hand, Dec. 31, 1912, was $179,367.53; accounts receivable, $2525.35; and ores in transit, $42,446.64. The last three items total $224,349.52, from which is deducted current accounts payable for the month of December, $21,587.02, making a total of cash on hand, $202,762.50.

The production of the company during the year was 46,683 tons of ore, which contained 4,716,047 lb. of copper, 131,867 oz. silver, and 259 oz. gold. The average copper content of first-class ore mined during the year was 7.35%. The average of the silver was 3.38 oz. The average content of the second-class ore was 4.05%, and of the silver 2.58 oz. per ton. The gross value of these metals was $739,196.08 and the net value after deducting smelter and freight charges was $415,528.55.

During the year, no ore was taken from the 2000-ft. level nor from the 800-ft. level, all of the production being from the 1200-, the 1600- and the 1800-ft. levels. Since Jan. 1, 1913, however, the sinking of the shaft

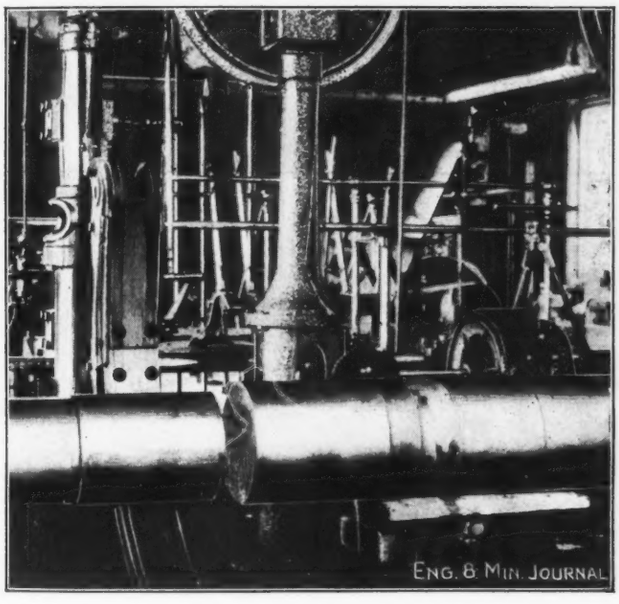
has been continued, and is now at a depth of 40 ft. below the 2200-ft. level. Drifting has been done upon the 2000-ft. level and a fine vein of good ore encountered. It is expected that the 2200-ft. level will be open within the next few months.

The hoisting equipment installed the year before last has proved entirely satisfactory and will be adequate to all the needs of the company for hoisting from 3300-ft. depth.

❋

Repairing a 12-In. Shaft without Removal

The advantages of the thermit process were amply demonstrated a few months ago when the Portland Gold Mining Co., of Victor, Colo., broke the main shaft of one of its hoisting engines. To install a new shaft would have cost about $2000, and kept the hoist out of service for at least a month. It was decided, therefore, to try to repair it in place with thermit. All materials were ex-



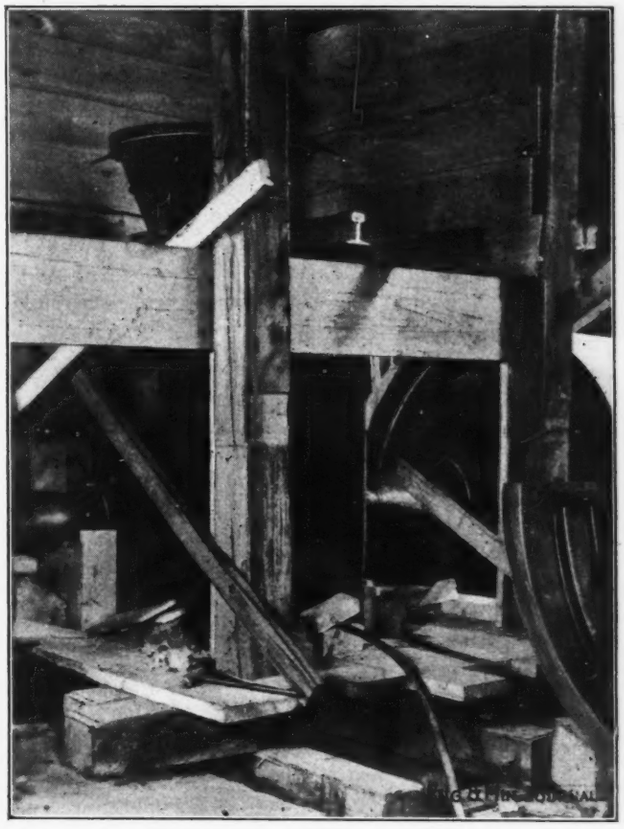
BROKEN SHAFT CUT OUT PREPARATORY TO WELDING

pressed from Chicago and an expert sent to supervise the welding. The repair was completed inside of 48 hr. after the materials and operator arrived.

Thermit is a mixture of aluminum and iron oxide which, when ignited by means of an ignition powder, reacts to produce superheated liquid steel and slag at a temperature of 5400° F. Advantage is taken of the high temperature of thermit steel for welding heavy sections together, as it is only necessary to open up a small space between the two sections, surround them with a mold, heat them red hot, and then pour in the thermit steel. This steel, being approximately twice as hot as ordinary molten steel, melts the metal with which it comes in contact and amalgamates with it to form a single homogeneous mass when cooled.

The only outside power required is a small supply of compressed air for the preheating blast. Aside from this, all materials and apparatus are light and portable and can be brought to the job so that heavy sections can be welded without being removed from their position.

In the case of the hoisting-engine shaft at Victor, Colo., a break occurred at a point where the diameter increased from 10 to 12 in. The first step in the operation was to provide a space 2½ in. wide between the two ends of the shaft to be welded together. Considerable difficulty was experienced in lining up the shaft as the engine had settled $\frac{7}{32}$ in. This was finally accomplished, however, and the work of forming a pattern for the mold was started at 1 p.m. This pattern was formed of yellow wax directly on the shaft, so that the molding material



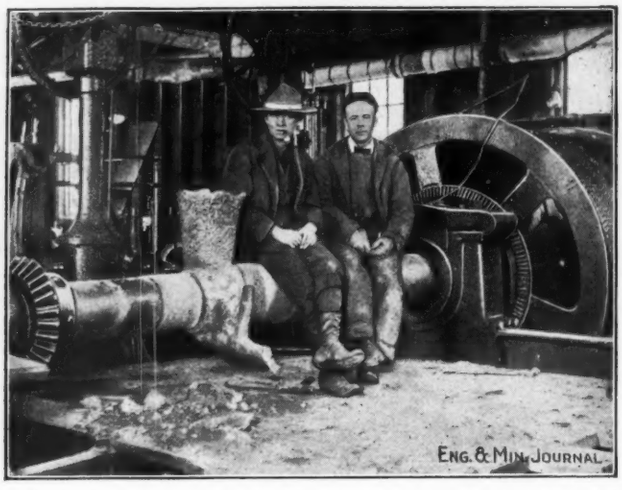
MOLDING BOX IN POSITION AND SHAFT BEING PREHEATED

could be rammed against it and the wax melted out afterward, leaving the mold ready for pouring. If a wooden pattern were used it would be necessary to make the mold in two parts, which would be cumbersome and difficult and there would also be greater likelihood of the thermit steel running out unless the two parts of the mold were carefully put together and luted.

The wax pattern permits making the mold in one piece and saves a great deal of time. The operator worked all night on the wax pattern and the ramming of the mold, after which the preheating was started and continued until the shaft ends had been brought to a red heat. Preheating the shaft was accomplished by the use of a gasoline and compressed-air torch, which was applied to the shaft through a hole cut in the bottom of the mold. After heating sufficiently, the torch was removed and the hole plugged. Preheating was finished the next day at 5 p.m., at which time the thermit steel was poured and the weld made. Seven hundred pounds of thermit were required for this weld, with which was

mixed 1% pure manganese, 1% nickel and 20% mild-steel punchings. Twenty-five gallons of gasoline were used in the preheating necessary to bring the shaft to a bright red heat while the mold was in place. The only dismantling required for the repair was the removal of the drum carrying the hoisting cable and the brake wheel which was directly over the fracture. Of course, it was necessary to remove all surplus metal after welding, and this was done by rigging up a cutting tool in place and starting the engine. The work was completed in about 24 hr., at which time the shaft was ready for service.

In most thermit repairs it is possible to leave on all the surplus metal which fuses around the shaft in the form of a collar or reinforcement. This adds to the strength of the weld and tends to prevent future breakage. If all of this extra metal is removed it cannot be expected that the weld will have as much strength as the original material of the shaft, but the experience of the Goldschmidt Thermit Co. has shown that the majority of crankshaft breakages are due to defective metal at some point in the shaft or else to unusual strains, such as might be caused by the backfiring of a gas engine, or exceptional overloading.



FINISHED WELD ON SHAFT, SHOWING METAL LEFT IN RISER

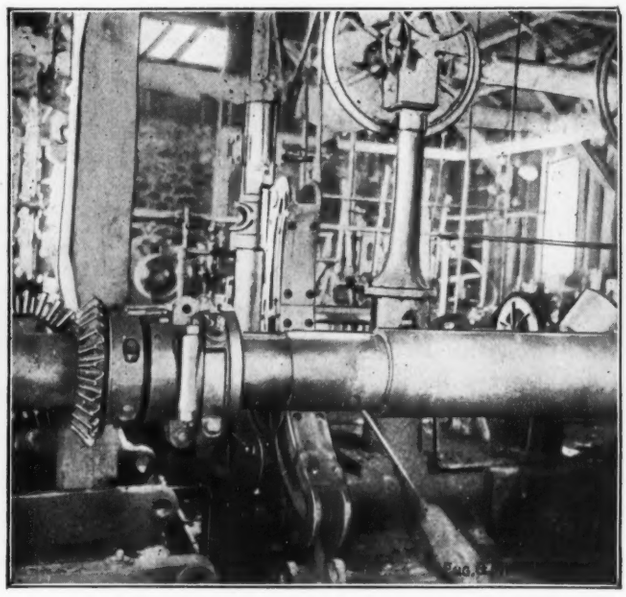
If the crankshaft is properly designed it should have a factor of safety of 5. The thermit weld with surplus metal removed will be about 80% of the strength of the shaft so that at the end of the welding operation the shaft will still have a factor of safety of 4, which should be sufficient for all ordinary purposes, particularly if the fracture was due to a flaw in material, which the repair eliminates. In any event the fact remains that such repairs are uniformly successful and the main-hoist shaft referred to above has been in operation since the early part of April without showing any signs of weakness.

New Idria Quicksilver Mining Co.

The report for 1912 of the New Idria Quicksilver Mining Co. states that during the year, 76,348 tons of ore were reduced, and 9600 flasks of quicksilver were produced. The net proceeds of quicksilver sales amounted to $289,675. Quicksilver on hand, Jan. 1, 1913, was worth $95,711. The decrease in supplies amounted to $10,359, and the interest receipts were $2458. The resulting amount, which is apparently considered receipts for the year, is $377,485. Total expenses, including repair, construction and development work, were $303,721, leaving net earnings of $73,764. Dividends of $120,000 were paid during the year.

The Mohawk Mining Co.

The annual report of the Mohawk Mining Co. for 1912 states that there were hoisted 868,641 tons of rock, which, after discarding poor rock, gave 787,941 tons of rock stamped. There was produced from this, 15,901,500 lb. of mineral, equivalent to 11,995,598 lb. of refined copper. The yield was thus 0.761% copper per ton. The cost of refined copper at the mine was 9.67c., increased by smelting, freight, marketing and office charges to 10.54c., and by construction charges to 10.61c. Receipts from copper sales at an average price of 16.08c. were $1,929,418, increased by account assessments of $10. Mine working expenses were $756,897, underground; $64,693, surface; $67,483, rockhouse; $95,717, transportation; $175,061, stamping; $8815, construction. Smelting, freight, New York and Boston expenses, brought the total expenditures up to $1,272,993, leaving net profits of $656,435. Dividends of $350,000 were paid during the year. Development work during the year included 14,464 ft. of drifting, and 305 ft. of crosscutting, and 635 ft. of shaft sinking.



COMPLETED REPAIR—WELD TURNED DOWN AND SHAFT READY FOR SERVICE

Improvements were made in company houses, in No. 2 coal trestle and around No. 6 shaft, as well as in the system of handling rock in Nos. 1 and 2 rock houses. A number of Leyner drills were introduced during the year, and it is intended to increase the total number of these drills in use. A new steel rock house and a new hoist have been contracted for; the latter will be capable of hoisting a 7-ton load from a depth of 4000 ft. Other changes during the year included an addition to the hospital and the beginning of an installation of an 8-ft. Hardinge mill and four Wilfley tables for experiments.

Milling in Southeastern Missouri—II

By Claude T. Rice

SYNOPSIS—The Doe Run No. 3 mill, described in detail, consists of four sections with a total capacity of 2400 to 2800 tons per day. The general system includes relatively coarse crushing and concentration. Gyratory crushers are followed by a system of trommels with rolls for crushing oversize. One large Hancock jig in each section handles the material between 2 mm. and 9 mm., the middlings product being reground in rolls and treated on another Hancock, which serves two sections. The material under 2 mm. is classified and concentrated on Harz jigs and Wilfley tables. Tailings are stacked by belt conveyors.

The Doe Run No. 3 mill is built in four sections, but in some parts two sections coalesce, as indicated by the accompanying flow sheet. The ore is discharged from the bin by means of roller feeders. There are three feeders in the outside section of the mill and two in the center section, but this apparently unbalanced condition is not important as only one feeder in a section is running at a time. These feeders are rotated by a gripping cam and work admirably, practically the only upkeep on them during three years' operations having been the occasional replacing of cams.

The ore from the roller feeders drops to a 14-in. Robins trough-belt conveyor that takes the ore to an incline conveyor of similar make and type. This belt passes over an 18-in. magnetic pulley which takes out any iron particles that may be in the ore and delivers the ore to the coarse trommel, which is 24 in. in diameter and 8 ft. long. The trommel is equipped with ¾-in. manganese-steel plates, having 1-in. holes, bolted to the four longitudinal ribs.

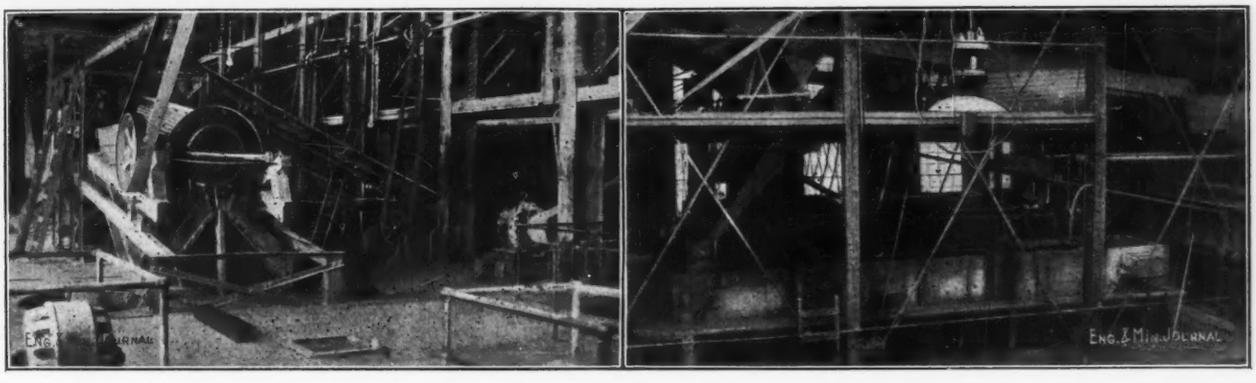
Manganese-Steel Trommel Plates Wear Well

These plates have been in use for three years and show little signs of wear. Similar manganese-steel plates on the coarse trommels at the Leadwood mill have been running seven years, handling approximately 900 tons per day and still are in fair condition and will last another year. Soft-steel trommel plates, ¾ in. thick, only lasted four months with the same feed. These trommels are gear driven but carried in trunnion bearings.

The oversize from the 1-in. trommel splits at the end of the trommel and goes down troughs to two No. 3 McCully gyratory crushers. In the crusher pits are placed automatic cellar drains for pumping any water that happens to get into them. The life of cast-steel gyratory heads was about 15 months with about 270 tons per day going to each crusher. For some time now manganese-steel heads have been used and these as yet show no signs of wear. The crushers are readily accessible for inspection and repairs.

Trommels Follow Gyratory Crushers

The ore from the crushers joins the undersize from the coarse trommels and is taken by a 16-in. inclined troughed belt conveyor to two 48-in. by 12-ft. trommels with 9-mm. holes. These trommels are made with a special diaphragm head to keep the coarse ore from falling directly on the trommel screens. They are covered with a canvas hood which prevents dust from getting out into the mill to any great extent. Formerly soft-steel punched screens about ¼ in. thick were used on these trommels. These would wear six months, handling during that time about 400 tons per trommel. Manganese-steel screeens furnished by the Manganese Steel Rail Co., New York, are now used on these trommels. These are about No. 10 gage in thickness and on that account do not give any trouble from blinding, while the thicker soft-steel screens had to be beaten rather frequently when they were new to keep them from blinding.



Doe Run No. 3 Mill

(Coarse trommel feeding McCully crushers.) (Hancock jigs and hydraulic classifiers.)

Rolls Crush Oversize

The oversize from each trommel falls into a small hopper pocket and is taken by a closed chute to 36x14-in. rolls of the Superior type. The chute is provided with a gate about three feet above the rolls, the chute being open below this gate so as to allow the roll men to see from a distance how much feed is going to the rolls. The rolls are equipped with 4-in. standard shells of Midvale steel. The shells are put on hot as described in another article. These shells are worn down to a thickness of about ¾ in. before being taken off. The shells last about 450 days and crush approximately 225,000 tons, making a steel

consumption of 0.013 lb. per ton, including the metal thrown away in the shell remnant. Grooves are taken out of the roll shells, as soon as they become at all pronounced, by lateral adjustments. Old side-liners are used to prevent the ore from getting in between the housing and the rolls while the rolls are out of their proper position.

The ore coming from the rolls drops on a 14-in. flanged-belt conveyor and is taken back to the main incline conveyor leading to the 9-mm. trommels. This is the only point at which a flanged belt is used. As soon as the supply of flanged belts is used up, troughed belts are to be used throughout the plant, for only in this place and at the trough conveyor at the tailings dewatering wheel do flanged belts show a good life, and the cost of the flanged belt is approximately one-third more than that of an ordinary 5-ply belt with the same thickness of rubber coating.

The undersize from the 9-mm. trommels drops into a hopper that feeds a closed chute that takes it to the dry elevator. In each chute a gate is provided so that the feed can be shut off when desired. The dry elevators are equipped with a special type of boot, having outside bearings for the bottom pulleys.

The dry elevator discharges to the 2-mm. wet trommels at the top of the mill on the eighth floor. It is at the top of this dry elevator that water is first added to the ore by means of a pipe that plays into the launder just beyond the catch box of the elevator. The wet trommels are 36 in. in diameter by 10 ft. long. The screens used are punched from No. 16 gage iron and last approximately 30 days, handling about 300 tons of ore per day. These fine trommels give some trouble from blinding and when new have to be beaten once every two hours. Two wet trommels handle the feed from each dry elevator. A feed box with baffle boards is used ahead of these trommels in order to break the current and cause the pulp to flow in a direction parallel to the screening surface of the trommel, thus preventing the rapid wearing of the first section of screen.

Large Hancock Jigs Used

The oversize from these trommels goes to the Hancock jigs (one for each section) that are handling original feed. These jigs are of the large 25-ft. size with screens approximately 4 ft. wide. They are carried on structural-steel supports from the second terrace 19 ft. below, but no trouble has been experienced from any vibration resulting from this. The trays are made of iron so that a gain of about three inches in effective screen width is obtained thereby. These jigs are run at 198 reciprocations per minute with an upward component to the stroke of 2 in. and a forward motion of 5/8 in.

Beside the tailing discharge box at the end there are five hutch or working compartments in the Hancock jig. Usually concentrates are drawn from the first three compartments and middlings from the last two. The nature of the products coming from these different compartments depends upon two things: First, naturally upon the screen aperture used on that part of the tray and, second, upon the thickness of the bed.

At this mill a 4-mesh No. 15 wire screen is used over the first two compartments and all but the last 12 in. of the third compartment. Over the last 12 in. of the third compartment and the whole of the fourth compartment a 3-mesh No. 13 wire screen is used. Over the fifth compartment a punched screen with 9-mm. openings is used, while at the tailing end of this compartment is a short length of a plate having 8-mm. openings. The larger screen is used on the tail end of the third compartment in order to draw off from the bed any concentrates too coarse to go off through the 4-mesh screen which would otherwise go to the fourth compartment and get into the middlings.

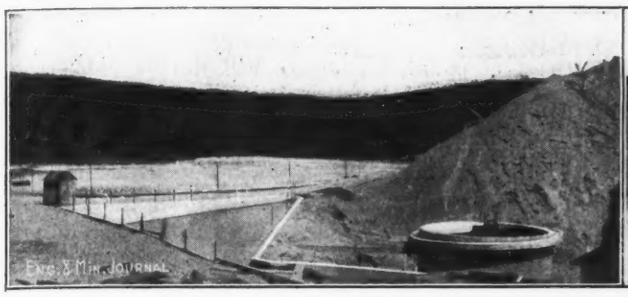
In sampling the tailings from these jigs, it is the custom for each shift foreman to take dipper samples hourly, by cutting through the stream of water and tailings issuing from a 5-in. iron plug cock partly opened, and set vertically under the bottom of the tailing compartment of the jig. As this is the only discharge from the jig going to waste, the method of sampling may be considered practically accurate. The water level in the jig is kept constant by means of a float over the tail end, which is connected by means of a rope and pulleys to a butterfly valve on the water-supply pipe. The main object of the sampling is to see how much included lead is being sent to the tailings; for only in the finest sizes is there any free galena going off the jig.

It is to get rid of the fines on the Hancock jig in order to prevent this loss, and also their continuous circulation in part as middlings, that the company is installing four complete units of Woodbury jigs, including the classifying jigs, in the two-section addition to the mill now in process of erection. The Woodbury jigs will be placed on the floor above, and directly over the Hancock jigs; this arrangement eliminates the 30-in. wet trommels which are necessary at present in the older sections.

Jig Middlings Reground

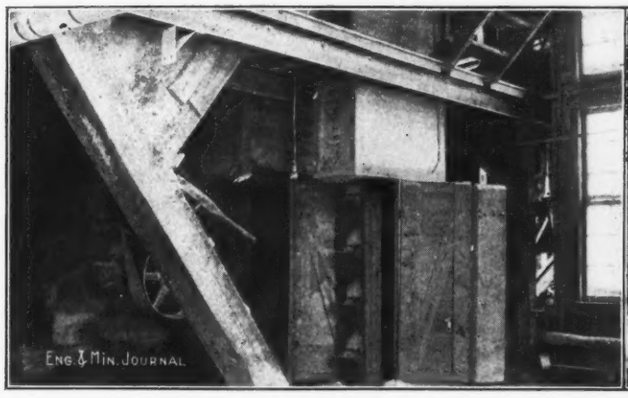
The drawoffs from the jigs are run open practically all the time. To each compartment there are two gates, one on each side of the jig. The launders from the gates on one side of the jig take the concentrates to settling tanks, while those on that side of the middlings compartments take the middlings to the shovel wheel feeding the regrinding rolls. On the other side of the jig all compartments discharge into a launder that takes the products to the wet elevator bypassing the rolls. When the attendant notices any free lead coming out of the gates on the middlings hutches he closes the gates leading to the rolls and sends the middlings to the bucket elevator, so as to return them to the jig without regrinding. Likewise when, owing to a drop in the grade of the feed to the jigs, the bed over the concentrates hutches gets too thin to furnish a clean concentrates product, the gates to the concentrate launders are closed and the concentrates sent to the elevator to be returned to the jig without being reground. Only the product from the last concentrate compartment ordinarily has to be returned, as the feed rarely falls below 3% lead.

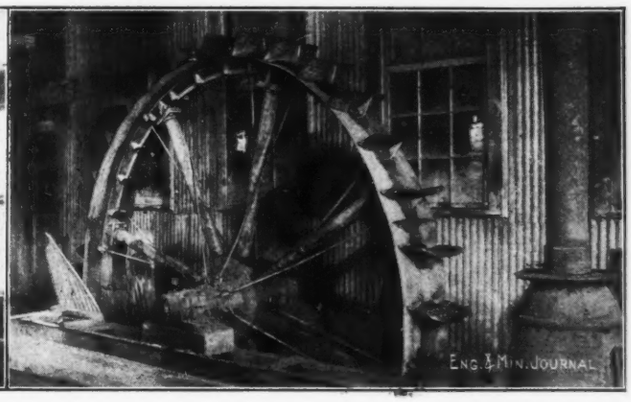
It is this changing character of the feed that is inherent in the manner of occurrence of the ore that makes it desirable to mix the ore at the mill bin as much as possible. The ore at the Doe Run mill probably varies more suddenly than at either of the other two mills in the district where the preliminary crushing is done in a central crushing plant and the crushed ore distributed by a movable tripper and a belt conveyor to the fine-ore bin at the head of the mill building proper.



DOE RUN NO. 3 MILL

(Tanks for settling fine tailing before entering pond.) (Method of stacking tailing showing the two extension belts.)





DOE RUN NO. 3 MILL

(Elevators showing doors at roll floor for making repairs.) (Shovel wheel for dewatering tailing before stacking.)

TABLE FLOOR, DOE RUN NO. 3 MILL

(Noteworthy features are underfloor drive, pipe distributors, water supplied from below by goosenecks.)

About 850 gal. of water per minute are used on these jigs. The jig screens last about eight months. In order to prevent losing the bed when the grade drops, a blinding screen of 4-mesh wire is kept on hand to cover the 3-mesh screen at the tail end of the third concentrate hutch.

Formerly the middlings from the jig went to a 36-in. by 6-ft. trommel with 3-mm. screen. The oversize was crushed in 30x14-in. rolls, while the undersize was reground in a 5-ft. Huntington mill. At that time, 3-mm. screens were used on the trommels feeding the Hancock jigs, and the Harz jigs were treating sizes ranging from 3 mm. down to 1 mm. Consequently, the middlings from the Harz jigs as well as the undersize from the 6-ft. trommel were reground in the Huntington mills. On the latter mills 10- to 16-mesh screens were used, and a large capacity obtained. But, since it cost from $25 to $30 per month to keep each mill in running order, with all the attendant trouble, a change to 2-mm. was made in the upper trommels, the undersize hydraulically classified, and the spigot sent to the Hancock jig, the next smaller size being treated on the Harz jigs. The Harz jigs thereafter made only a hutch concentrate, with the tailings going to waste, while all the Hancock jig middlings are now crushed by rolls. The regrinding rolls are of the spring type and are set face to face. No trouble is experienced in keeping the shells from grooving because the ore is rather fine and also the limestone gangue is soft, although tough to break.

Shovel Wheels for Dewatering

The Hancock jig middlings are sent to vertical shovel wheels to be dewatered. The water and fine pulp overflowing from the box of the dewatering wheel go to a V-box and the coarser particles that settle are sent to the wet elevator to be returned to the screening system. The recrushed middlings from the rolls drop into the feed box of the wet elevator. On this elevator a 12-in., 5-ply belt with a $\frac{3}{32}$-in. covering of rubber reinforced on the feed side is used; this lasts about a year and a half. The elevator is run at 375 ft. per min. over 36-in. pulleys.

The wet elevator discharges to a 3x6-ft. trommel having 2-mm. punched screens. The undersize goes to the classifiers along with the undersize from the other 2-mm. trommels previously mentioned. The oversize goes mainly to the middlings Hancock jig, but this middling feed is too much for one jig to handle so some of the feed is returned to the first Hancock in each section, while some oversize from the first 2-mm. trommels has to be taken to the middlings jig to maintain the bed. One middlings jig serves two sections, as the flowsheet shows. In no way is the treatment or the arrangement on the middlings Hancock different from the one treating mainly original feed.

Hancock Jigs Have Large Capacity

The great advantage of the Hancock jig is its large capacity and its ability to handle efficiently an unsized feed down to a fineness of about 1 mm.; it is best adapted to treating low-grade ores. These jigs are each treating approximately 600 tons per day. Most of the lead in the Hancock jig tailings is included lead. Therefore, it is no fault of these jigs that much of the lead is in the tailings. The leaving of it there unfreed by the crushing is purely a question of milling economics. Because of the avoidance of close sizing, which was required with the old Harz equipment, the greater capacity of the Hancock jig and the less number of machines to be watched, the cost of power, attendance and jig maintenance per ton of ore treated is much less. Not only is the operation much simplified by the use of these jigs, but much less floor space is required and the first cost is also less. When the Hancock jig is not being crowded, there is a marked stratification of the bed according to size. Owing to this stratification it is possible to draw off the larger sizes of tailings in the last middlings compartment and discharge as fine or as coarse tailings as desired.

The disadvantage of the Hancock jig is that it does not make a good recovery on sizes smaller than, say, about 1½ to 1 mm. when treating a product ranging down from 9-mm. size, nor is there any way, unless special equipment is installed on them, as at the Federal mill, to take off clean galena particles too coarse to go through the concentrate screens before they find their way into the middlings. This with such friable ore as galena is a great drawback. Moreover, there is no way to maintain an even depth of bed when there is any marked variation in the grade of the ore.

The undersize from the 2-mm. trommels, both those treating the original ore and the one treating the recrushed middlings, goes to a crossover set of launders on the seventh floor. By this arrangement of crossover launders and gates it is possible to maintain an even feed to the two sets of hydraulic classifiers in each section, even when one trommel is down for any reason. Before going to the main classifier the pulp goes to a one-compartment annular classifier so as to remove the heavier part of the undersize and not overload the Harz jig. The spigot product from these first classifiers, which formerly went to Harz jigs when the mill was not treating so large a tonnage, carries 12 to 15% lead and is taken to the Hancock jigs.

The overflow from each of the first classifiers goes to the main classifiers which have four spigots, being equipped with a Richards annular classifier for each pocket. Formerly, Richards vortex classifiers were used, but they required too great a dilution of the pulp to do good work.

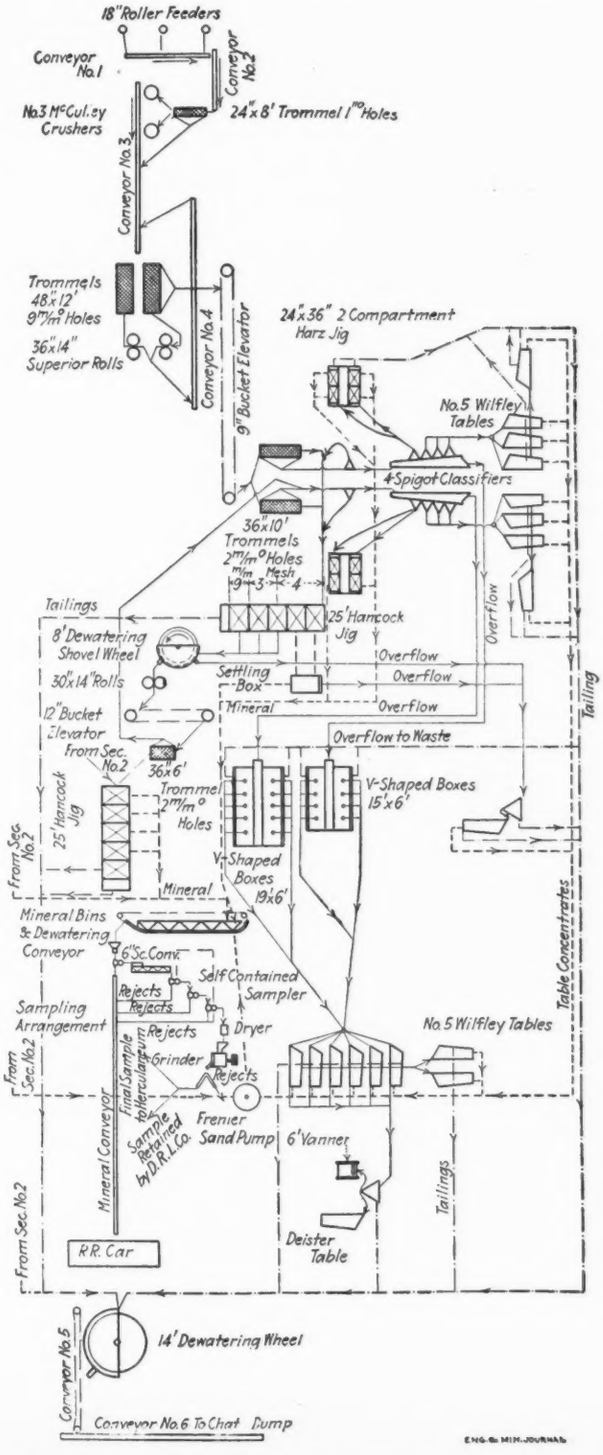
The discharge from the first spigot of the 4-compartment classifiers goes to two double-compartment Harz jigs having iron bodies. The sieves of the jigs are 24 in. wide by 36 in. long. On the first compartment a 6-mesh No. 17 wire screen is used, while on the second compartment a 7-mesh No. 18 wire screen is used. The jigs run at ⅝-in. stroke and the eccentrics make 240 r.p.m. A bed about two inches thick is maintained on the jigs. The overflow from the settlers feeding the tables is used as jig water. Each jig is treating 30 tons per day and is fed 30 gal. of water per minute. Only a hutch concentrate is obtained. The middlings from these jigs are small in quantity and are shoveled off once a day into the launders leading to the shovel wheels that feed the regrinding rolls. The screens on the Harz jig last about 10 months.

The pulp from the last three spigots of each battery of classifiers goes to a distributing box above the tables. The table floor presents a neat appearance due to the fact that the pulp is distributed to the tables by pipes instead of launders; that the wash water comes up from below through goosenecks; and that the tables are

equipped with an underfloor drive. The last three spigots of each classifier feed three Wilfley tables.

The overflow from each battery of classifiers goes to V-bottomed settling tanks. The thickened pulp from the settlers in each section is fed to six Wilfley tables. The overflow from the shovel wheel feeding the regrinding rolls also goes to a settling box and after being thickened goes to a table on the lower floor.

All these tables have steel bodies and are made with a lip launder forming an integral part of the top for catching the tailings. The deck is riffled so as to have the diagonal termination of the riffles end six riffles up from the corner of the table. In this way the division between concentrates and middlings is made at the concentrate end of the table where it will not be distorted by the table stroke. This riffling of the tables also spreads the feed in a broader band so that the tables can be run with less slope and less water. A corrugated plate is also fastened to the discharge end of the table so that the concentrates and middlings discharge in a series of drips. This permits a closer split to be made, while it also allows for about ¼-in. change in the division line.



FLOW SHEET, ONE SECTION, DOE RUN NO. 3 MILL

In order to protect the linoleum on the tables handling the coarser concentrates, a sheet of No. 28 terne plate of 30 lb. coating is tacked to the table top. This is 30 in. wide runs in a strip across the table about parallel with the terminations of the riffles and about 12 in. back. Before this was put on, the linoleum on the coarse tables only lasted about a year, but now it lasts two years. The coarse tables have to be reriffled about once in eight months.

The middlings from the tables on the first floor are taken to settling boxes on the floor below and then reconcentrated on other Wilfley tables. This is done to make a better separation between the galena and the other sulphides in the ore, for on the tables of the main floor the split is made so as to assure clean lead concentrates. The slime from the tables on the upper floor is also settled and re-treated on Wilfleys on the lower floor. The slime and middlings from the tables treating slime on the upper floor are settled and treated on vanners and a Deister or a Wilfley table. The Deister table is preferred for this work.

On the tables treating the middlings from the tables handling the coarser sand about 1000 lb. per day of copper concentrates are obtained that assays about 15% copper. This copper is inclined to come in local areas in the orebody and is not of widely scattered occurrence. The copper, which is mainly in the ore as chalcopyrite, slimes badly, making clean separation difficult. The concentrates from the slime tables contain from ¼ to ½% of copper as they are shipped to the smeltery at Herculaneum.

The tables on the lower floor are driven from overhead by the same line shafts that drive the tables on the main floor. In distributing the finer sizes of table pulp, ordinary garden hose is used. About 6 gal. of water per min. are used per table in the fine-concentrating department.

The concentrates from all jigs flow by gravity to the concentrates tanks, while the table concentrates are elevated to these tanks by Frenier pumps one to each half of the mill. These concentrate tanks are a series of concrete hoppers that discharge a thickened pulp into a cast-iron launder extending along the bottom. The concentrates are moved along this launder by a drag conveyor which also acts as a dewaterer, since the launder is inclined upward at the end. The upkeep on the drag conveyors amounts to about $700 per year, or 1.5c. per ton of concentrates handled. This is due mainly to the wear on the rollers resulting from the concentrates getting into the bearings.

The concentrates, which are discharged with about 7% moisture, are sampled by an automatic device of original design as they fall to the conveyor belt that takes

them to the railroad car for haulage to the smeltery. The overflow from the concentrates tanks goes to a series of settling tanks so as to catch any overflowing slime.

The tailings from the different concentrating devices all come together at the bottom of the mill and go to the tailings wheel, one to each half of the mill. These wheels, which are 14 ft. in diameter, raise the tailings about three feet and discharge them at about 7% moisture to the conveyor belt that is used to stack the coarse tailings.

Tailings Stacked by Belt Conveyors

These tailings belts are 20 in. wide and are carried up a slope of about 12°. This stacking system consists of a main conveyor belt, an extension and a side belt, the lengths being 250 ft., 165 ft., 185 ft. and 315 ft., respectively. In the case of both distributing belts, the upper end is extended over the dump by a trestle. At this point, as the tailings are discharged, water is added to help wash the tailings down the pile and distribute them over a larger area than would be possible without this addition. While the straight-away extension is in use, the side belt is being extended.

The fine tailings that overflow with the water from the shovel boxes are taken to a small concrete settler 20x20x 10 ft. deep. The overflow from this settler flows in 24-in. terra cotta tiling to the settling pond that holds approximately 3,000,000 gal. of water. In the pond the slime settles near the discharge gates and the water is pumped back to the mill to be used again. The settled slimes are sluiced off in 48-in. tiling through the tailings pile. The settled pulp from the first settling box is sent to a 10x10-ft. cylindrical concrete tank. The settlings from this tank are returned to a table to be re-treated while the overflow goes to the big pond.

The mill is treating from 2400 to 2800 tons per day. The heads average from 5 to 5½% lead; the general tailings assay from 0.4 to 0.8% lead, the total extraction being from 83 to 86% of the lead. The heads of the Hancock jig, on account of the adding of the underflow from the one-spigot classifiers, average about 6% lead, and the tailings, not considering the overflowing slime, assay 0.6%. The Harz-jig heads assay 5% lead, and the tailings 0.5%. The feed to the coarse sand tables assays 5% and the tailings 0.3% lead. The feed to the fine tables assays about 4% lead, and the tailings average approximately 1%. The concentrates from the whole mill assay about 64% lead, 1.9% zinc and 0.78% copper. The concentrates from the Hancock jigs assay about 65% lead, those from the Harz jigs 67%, those from the sand tables 70%, those from the slime tables 50% and those from the middlings tables 50 per cent.

The costs of milling are as follows: Operating labor, 6 to 8c.; maintenance and repairs, 7 to 10c.; power, etc., 8 to 12c.; insurance and depreciation, 4c.; total cost, 26 to 34c. per ton of ore milled. The operation of the mill requires the services of 23 men, including the shift boss, per shift, the wages paid ranging from $1.65 to $2.85. The unloading crew includes a foreman at $2.35 and eight men at $1.85 per shift. The machine shop operates only on day shift, the crew being composed of 11 men, and the wages ranging from $1.65 to $2.60 per day.

The mill was designed by H. R. Wahl, under the supervision of O. M. Bilharz, the general manager of the company. From the beginning, the mill has worked well, and the changes made, with the exception of discontinuing the use of Huntington mills for regrinding, have all been in the line of increasing the capacity of the mill so as to relieve the older mills of the company as much as possible, as they do not make as good a saving. The increase of its capacity having been effected, efforts are now being directed toward further increase in the metallurgical efficiency. An addition to this mill consisting of two sections of 1500 tons capacity will be completed by Aug. 1, 1913, so that the total capacity of No. 3 mill will be 4000 tons. I am indebted to H. R. Wahl, O. M. Bilharz and Frederick Reichert, mill superintendent, for many kindnesses shown me at Rivermines while writing this article.

(To be continued)

Mining and Smelting in New Caledonia in 1912

M. C. du Poizat, in *Echo des Mines*, writes of the progress of mining and metallurgy during 1912, in New Caledonia, says the *Mining Journal* (May 10, 1913). The total export of minerals from New Caledonia in 1912 did not exceed £560,000. The following mentioned figures show the ores and mattes shipped:

	1911 Tons	1912 Tons	Value £	s	d
Nickel ores	120,059	72,315	1	7	2
Chrome ores	32,806	51,500	1	8	0
Nickel mattes	2,933	5,097	28	0	0

There are 800 nickel concessions, but only 40 are being exploited. The following are the principal companies, with their production in metric tons during 1911:

Société le Nickel	47,000	Consolidated Mines	12,000
Badoux & Metzdorf	16,000	Bouteiller & Suaud	10,500
Vieux & Talon	17,750	De Béchade	10,000
F. & G. Schmidt	10,780	L. Ballande	8,000

The oxide of cobalt, arising as a byproduct from the treatment of arsenides in the Cobalt mining district, has so depressed the value as to cause the suspension of the New Caledonian mines.

The metallurgical installations of the island have been in successful operation for two years. The Société le Nickel at Thio has a 100-ton furnace, capable of smelting 30,000 tons of ore per annum. At Point Doniambo the Nouméa works in 1912 smelted 36,000 tons of 5 to 6% ore. The hydro-electric furnace at Tao is out of blast. These three establishments have exported mattes in metric tons as follows:

	Matte	Per cent.	Metal
Hautes-Fourneaux de Nouméa	3,314	45	1,491½
Société le Nickel	1,600	45	720
Société de Tao	103½	50	51¾
Total tons of pure nickel	.....	..	2,263

If the Customs value of £28 per ton of nickel matte be accepted, the 5000 tons exported in 1912 would have a total value of £140,000.

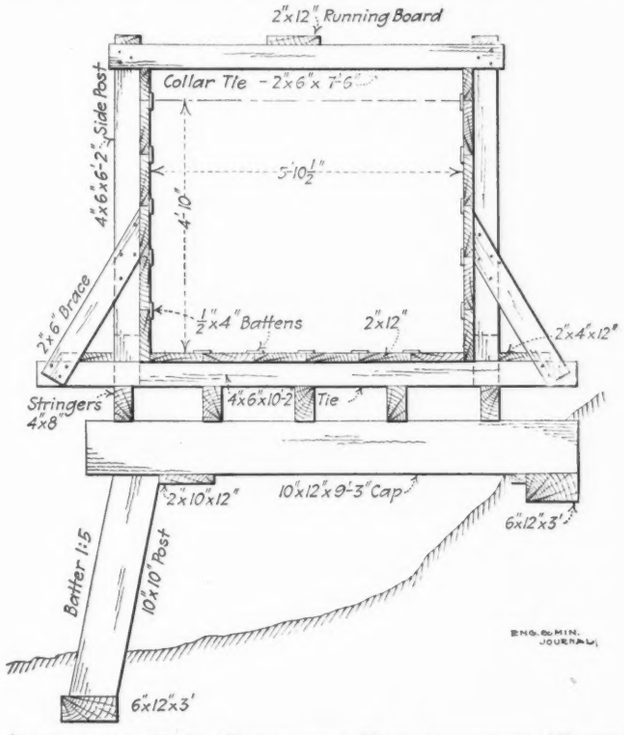
The Chrome Co. intends to construct a hydro-electric works of 15,000 hp. for the purpose of manufacturing ferrochrome and ferronickel. The primitive methods of mining have been superseded by modern practice, which has already given favorable results. The want of employment from which the colonists suffered, has been succeeded by an activity which promises to inaugurate an era of prosperity, assured by the increasing use of chrome and nickel in the manufacture of war material.

DETAILS OF PRACTICAL MINING

Details of Flume Construction

By Arthur W. Stevens*

The Boise King Placers Co. is engaged in the construction of a wooden flume to bring water from the Middle Fork of the Boise River to some placer ground owned by the company. The flume will be five miles long, have a grade of 0.2% and carry 200 sec.-ft. of water. The accompanying cross-section shows the dimensions. The mud sills, of 6x12-in. material, are three feet long. The inclined posts on these have a batter of one in five; are 10x10 in. in section and of a length to fit the ground. These posts carry a 10x12-in. cap, 9 ft. 3 in. long. Five stringers on these caps are 4x8 in. in section and 16 ft.



Section of Wood Flume for Hydraulicking Water Supply

long, the bents being spaced eight feet. The flume-frame sets are built of a 4x6-in. by 10-ft. 2-in. cross tie, two 4x6-in. by 6-ft. 2-in. posts, two 2x6-in. by 7-ft. 6-in. collar ties, one on each side of the posts, and four 2x6-in. diagonal braces from cross tie to post, two for each post. These sets are placed every four feet. The flume box is made of 2x12-in. planks, 16 ft. long, battened on the inside with ½x4-in. strips. An 8-in. splash-board is added. A running board of 2x12-in. material is laid in the center of the top.

In building the flume, stakes are first set eight feet apart; the graders dig down to a firm foundation and set the mud sills; and the engineers give the length of the post to go on each mud sill. The carpenters set the posts and caps, and a gang behind them lays the stringers and cross ties; a third gang lays the bed of the flume; a fourth, the posts and sides; and a fifth, completes the erection.

The lumber is obtained from two sawmills with a capacity of 20 M. each, per day, especially erected for the purpose. One of these is run by a 5-ft. double-nozzle, overshot Pelton wheel working under a head of 135 ft. and one is driven by steam obtained from two boilers. Both mills have gang edgers and cutoffs, since every timber is cut to exact dimensions in the mill so far as it is convenient to do so. The entire consumption of lumber will be 2208 M., b.m., not including one of the high trestles.

Nails to the extent of 71,900 lb. will enter into the construction of the flume. The freight on these for a 75-mile wagon haul over mountain roads from Boise, is a large item. These nails will be in the following amounts: 6-d., one keg; 8-d., 108 kegs; 10-d. 11 kegs; 12-d., four kegs; 16-d., 16 kegs; 20-d., 54 kegs; 30-d., 242 kegs; 40-d., 241 kegs, and 60-d., 48 kegs.

At the intake of the flume, there is a diversion dam 8 ft. high and 110 ft. long, with a 16-ft. spillway. The flume passes over one trestle 60 ft. high and 300 ft. long; another, 90 ft. high and 150 ft. long, and two smaller ones. At present something over half of the flume is completed and it will be entirely finished before Aug. 1, when hydraulicking operations are scheduled to begin.

*Superintendent, Boise King Placers Co., Atlanta, Idaho.

Handling Sludge from Diamond-Drill Holes

By H. P. Bowen*

The method of saving the sludge from diamond-drill sampling described in this article avoids the use of the clumsy sludge box or barrel commonly employed for this purpose. A coarsely woven jute ore sack, with dimensions 15x27 in., inside of which was placed a cylinder of coarse copper screen to hold it open, was set in an ordinary sludge box and the water from the drill hole run into it. With care to see that the water did not run over the top of the sack, it was found that the amount of slime passing through the sack was practically negligible.

Since the amount of water used by different drill operators and in drilling different classes of ground varies, this method needs careful attention to avoid loss. The following modification was then devised and is now being used with satisfactory results.

To the end of the discharge pipe from the drill casing a cross is connected, a short length of pipe being fitted to each of the three arms. Each of the latter pipes is inserted into a coarsely woven sack and the neck of the sack tightly tied around it. All water from the drill hole must pass through the sacks. After the sample has been

*Miami Copper Co., Miami, Ariz.

taken the sacks with their sludge contents are removed and placed on steam coils to dry. When dry, the sample is removed and the sack thoroughly beaten to loosen adhering particles. It is found that with care a sack can be used three times, after which it becomes so porous as to be worthless for this purpose.

The same method was tried on the sludge from churn drilling, but without success, since the sludge is pounded to pulp instead of being cut into sand particles as in diamond drilling. As a result, the churn-drill sludge fills the interstices of the sacking almost immediately, rendering it practically impervious to the passage of water.

Insulation for Shaft Electric Cables

Although high electrical pressures are not carried down mine shafts at present, voltages of 6600 are known, and the tendency will probably be to use higher voltages so that even 11,000 volts should not be unusual. As the pressures increase, of course, the matter of insulation will become increasingly important. E. Kilburn Scott, in a paper read before the Association of Mining Electrical Engineers of England, Feb. 7, 1913, describes the different insulating materials used.

A solid bitumen cable is one in which the conductors are imbedded in a mass of pitchy material of which the component parts are cottonseed pitch, Trinidad bitumen and sulphur. To be sufficiently elastic to prevent cracking, and, at the same time, not to flow down the cable at mine temperatures, it is important to obtain the proper consistency for the mixture. One advantage of this type of insulation is its excellent resisting quality to corrosive mine waters.

Although rubber has been largely displaced by paper and bitumen for power cables it has always held its own for lighting cables and those heavier cables where flexibility is important, as for sinking pumps. The siliceous rubber used in vehicle tires has been adopted for covering cables used on the surface and has given satisfaction in both its insulating and wearing qualities. This would seem to be an excellent material for insulating cables for mine shafts. Its high coefficient of friction would render it available for support by cleats.

Paper has a distinct advantage over bitumen in the fact that it cannot move away from the conductors or flow down the cable. Furthermore, its dielectric strength is greater. But it must be protected against moisture, and for this purpose is usually sheathed in lead, although bitumen sheathing with tapes can also be used. A special insulation which goes under the trade name "Indestructible" consists of layers of paper with a cotton or jute braiding, the whole impregnated with red lead and linseed oil. This covering seems to have excellent resisting qualities. Lead-covered cables frequently have a thin copper sheath immediately underneath the lead so as to increase the conducting power and prevent the lead from melting in case of a heavy leakage.

Impregnated jute was frequently used at one time for insulating low-voltage cables and was apparently satisfactory. The use of jute is open to the objection that it may become saturated with water and thus increase the weight of the cable. Other fibers would seem to be available similarly to jute, but so far as known they have not been to employed.

Concrete Stringers in Steep Inclines

The installation of a concrete skiproad in a steep incline is a much more serious problem than a similar installation in a flat incline. The concrete stringer itself must be firmly anchored to the foot wall and there is a constant tendency for the rails to creep down the shaft.

In the Copper Range shafts, which dip at an angle of 70°, concrete stringers of the Ahmeek type were tried and found unsuitable. The hammer of the skips is increased by operating at a steep angle, since they swing more on the rope and ride less smoothly. As a result, the nuts loosened on the bolts, which held the rail to the concrete and an elliptical hole was soon worn by the bolt in the concrete. Inspection of a 70° shaft is difficult and

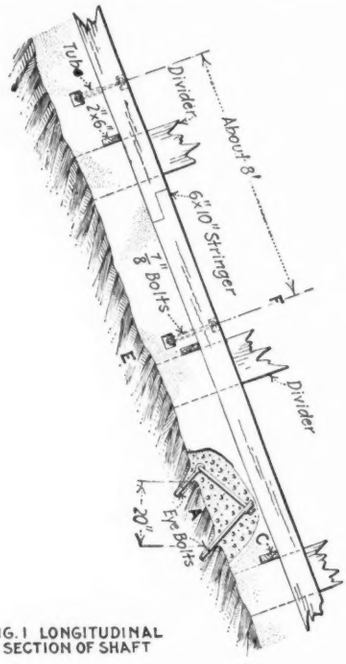


FIG. 1 LONGITUDINAL SECTION OF SHAFT

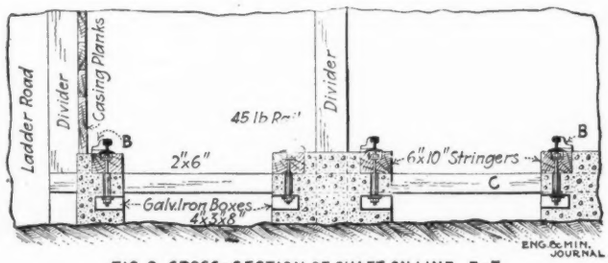


FIG. 2 CROSS-SECTION OF SHAFT ON LINE E-F

ANCHOR FOR STEEPLY INCLINED CONCRETE SKIPWAY

it was necessary to devise some method of holding the rails, which could be depended on for at least a week at a time, until the Sunday inspection took place.

The system illustrated in the accompanying drawing was originated. Instead of being laid directly on the concrete or on wooden crossties, the rail is spiked to a continuous 6x10-in. wooden stringer lying longitudinally in the concrete base and occupying the upper, inner corer of it. The rails are notched in three places on each side of a 30-ft. length to receive the spikes, which are thus better able to resist motion down the shaft. A cast-iron brace is spiked against the outside of each rail

end to prevent spreading, as shown at *B*, Fig. 2. The wood stringers are bolted to the concrete at about 8-ft. intervals. Access to the bottoms of the bolts is had through 3x4-in. galvanized-iron boxes, which are set in the concrete, but do not extend through it. The bolt is carried through a tube and is countersunk at the upper end, the countersunk hole being covered by the base of the rail so that the bolt tops cannot be broken off.

The concrete is held to the foot wall by anchorages, as shown at *A*, Fig. 1. These are put in about every 25 ft. They consist each of two pairs of eye-pins set in 10-in. holes drilled in the foot wall and held by the concrete cast around them. The lower pins are fastened to the upper by bolts and to increase the bond, four short pieces of drill steel run across.

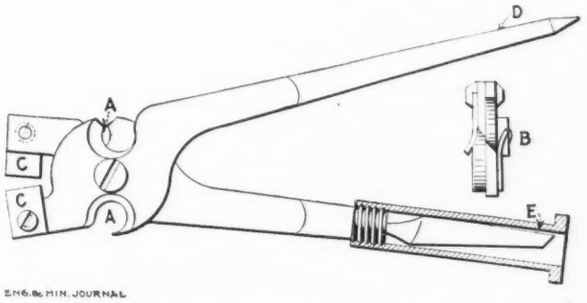
The concrete is cast flush with the top and side of the wood stringers, is continued to the wall or the divider in the case of the outside stringers and poured as one block for the adjacent stringers of the two skipways. This is in order to leave as little opportunity as possible for a rock to lodge and derail the skip.

In constructing the skiproads, the foot wall is cleaned and 2x6-in. crosspieces *C* fastened to the dividers, are set to grade by the surveyor. The wood stringers are laid in the proper position on these, the bolts and galvanized-iron boxes set in, and the forms built up of 2-in. planks. The 1 : 2 : 6 concrete is mixed at the bottom station of a 200-ft. lift and hoisted in a bucket to the shoveling plat from which it is transferred to the forms. This interferes less with mining operations.

❋

Aragon Pocket Fuse Cutter

A miner's tool for cutting fuse and making primers has been invented by Clements L. Aragon, of Ely, Nev. (U. S. pat. 1,047,910). Its general construction is evident from the drawing. The circular recesses at *A* are for use in cutting the fuse, working similarly to the



Pocket Tool for Cutting Fuse, Crimping and Preparing Primers

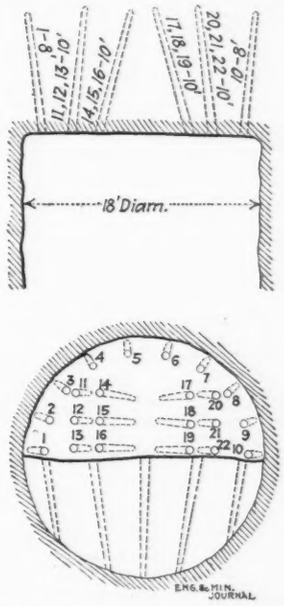
wire-cutting devices in certain types of pliers. The end portion *B* is provided for slitting the end of the fuse longitudinally, preparatory to spitting. The plates *C* are secured to the jaws by screws and have their free edges flared away as seen in the end view. This is to facilitate the entrance of the fuse end and also to give a rolling motion and consequent compression of the fuse, so that when the cutting edges come into action, the covering material will not be torn or the powder spilled. The end of one handle *D* is pointed for punching a hole in the powder to insert the cap. The end of the other is a knife blade protected by a screw cap *E* with an open end so that the knife edge or point will not be injured.

❋

Aqueduct Tunneling Methods

Typical tunnels on the Catskill aqueduct are the two headings from shaft No. 6 of the Pittsburgh Contracting Co., at Aqueduct and Tremont Avenues, in the Bronx. The tunnels are driven by the heading and bench method, the heading, which takes up the upper half of the tunnel section, being kept about 10 ft. in advance. The tunnel is circular in section, roughly 18 ft. in diameter, necessitating the removal of 9.42 cu.yd. of spoil for every foot of advance, or approximately 70 cu.yd. for every day's advance of 7.5 ft. This would be considerably more when considered in terms of loose material; probably 90 or 100 cubic yards.

The finished tube, says S. W. Symons, in *Compressed Air Magazine*, April, 1913, will be lined with concrete to a thickness of 1½ ft., reducing the diameter to 15 ft.



Typical Aqueduct Tunnel, Showing Cut and Bench Holes

An accompanying diagram of the breast shows how the holes are placed and fired. Six 3¼- or 3½-in. piston machines are used, mounted on three columns, two arms and two drills to each column; holes Nos. 1, 2, 3, 4, 11, 12, 13 are drilled from the left-hand column; Nos. 5, 14, 15, 16, 6, 17, 18, 19 from the center column; Nos. 20, 21, 22, 7, 8, 9, 10 from the right-hand column. The lower arms are then swung around and the drills turned down for the bench holes, all holes being drilled without changing the set-up of the columns. All holes are started at three inches in diameter and bottomed at 2¼ in., rose and cross bits on 1¼- and 1½-in. hexagon-steel being used. Great care must be taken to break the rock section true to shape and size in order to keep down to its minimum the amount of concrete in the lining.

Drilling is started about 4 p.m. and the round is completed in one shift. Blasting is carried on from 4 a.m. to about 7 a.m., the holes being shot by electricity; 700 to 800

lb. of powder is used per day for both headings; side and bench holes are loaded with 10 to 12 lb., and cut holes with 9 to 10 lb. The short cut holes and the bench are shot first, the long cut second and the back and side holes last. The heading has been advanced steadily at an average rate of 7½ ft. per day.

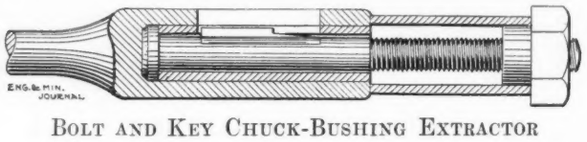
A saving is made in the time of the high-priced drill runners by having the mucking crew set up the drills, ready for the next round, as soon as they have cleared away the breast. This means that the drill runners can begin work without delay. The drill crew for each heading consists of six drillers, six helpers and a water boy.

For tramming, a double track is laid from the shaft to within a short distance of the breast, and a single overhead trolley wire supplies current for a small electric mine locomotive. From the end of the permanent track to the breast, rails are laid on their sides and the flanges of the truck wheels run in the channel section, the locomotive taking its power through a length of wire connected at one end to the overhead system, the other end being wound on a winch attached to the locomotive.

In mucking, an overhead system of planks is laid from the bench to the end of the car tracks, supported on bars set between the sides of the tunnel at a height to allow the mine trucks to pass underneath. Two cars are run as close to the breast as the muck will allow; part of the mucking gang work on the floor of the tunnel, shoveling into the nearest truck and working toward the breast; the rest work on top of the muck, shoveling into barrows on the overhead system and working away from the breast, the barrows, of which two are kept going, are emptied into the farthest mine truck.

Device for Extracting Chuck Bushing

The ordinary method of removing a chuck bushing from a machine drill is to insert a drift through the opening in the chuck in which the key or drift fits. The



Bolt and Key Chuck-Bushing Extractor

drift is then struck with a sledge until the bushing is forced out. In most cases, says J. F. Berteling, in *Mine & Quarry*, April, 1913, the bushing is ruined if the method succeeds. A cold chisel is often needed to split the bushing, or the chuck is heated in a forge and expanded, enabling the bushing to be driven out more easily. Even on new machines considerable difficulty is encountered in removing bushings, and if the bushing has been rusted in, it is a difficult job. Drift keys are made up for this purpose, so as to exercise a better leverage on the bushing, but, while superior to home-made drifts, they are open to the chief objections described.

The accompanying drawing shows a method devised by Charles Berg, master mechanic of the Reserve Mining Co., near Commonwealth, Wisconsin. This method consists in pulling the bushing out of the chuck instead of driving it out. A steel rod of suitable size is threaded at one end with a heavy thread of coarse pitch. At the other a suitable slot is cut in which a steel wedge is laid, carrying a square shoulder. This rod is inserted in the chuck, the wedge placed in position through the key or clamp opening, and a short piece of heavy pipe placed over the threaded end of the rod. A heavy nut is then screwed on over the free end of the rod, until it abuts against the section of pipe. As it is screwed in it pulls out the rod and brings the shoulder of the wedge against the edge of the hole in the bushing. The inclined surface of the wedge being underneath the bushing, the entire device is solid and secure, and in most cases the bushing can be drawn out without damage to itself or to the chuck.

Safety Rules—Mining*

(1) All dangerous places underground should be properly fenced off.

(2) If mechanical haulage is employed, there should be no stretches more than 200 ft. long on any main haulageway, which afford a continuous space of less than 2½ ft. in width between the widest portion of the car or tram running on the tramway, and the side of the drift.

(3) Safety alcoves, or places of refuge, 4 ft. wide and 2½ ft. deep should be provided at intervals of not less than 130 ft. along tramways.

(4) Winzes and raises should not be started nor holed in the direct line of a main drift, but should be offset, except where, in the judgment of the superintendent, it is necessary.

(5) The opening of an offset winze should be protected by a fence or guard rail not less than 3 ft. or more than 4 ft. above the level of the drift.

(6) Existing winzes opening directly from the floor of the drift or stope should be kept covered by a substantial hatch, or planking, except when in use, at which time passage to persons other than those working at the winze should be barred off by a substantial rail across the roads of access to the opening.

(7) No raise should be allowed to approach within 10 ft. of any portion of an opening in which there is a dangerous accumulation of water, unless the water be first bailed, or pumped or removed by means of a bore hole from the raise.

(8) When advancing a drift, adit level or incline toward a mine working that it is suspected contains water, a bore hole should be kept at least 20 ft. in advance of the breast of the drift, and, if necessary, in directions laterally from its course.

(9) Watch and listen for danger signals, bearing them in mind at all times.

(10) Every manhole and place of refuge shall be kept constantly clear and no refuse or other material should be placed therein. No person shall in any way prevent access thereto.

(11) Planking over sumps and ditches should be kept in first-class condition.

(12) Drifts must not be robbed so as to leave large openings above the timbers, which, should the roof cave in, would be liable to break the timbers and crush anyone underneath.

(13) Employees shall inform the captain or shift boss immediately after discovering any unsafe place so that prompt precautions may be taken to avoid the possibility of accident.

*From Inland Steel Co. book of rules.

DETAILS OF METALLURGICAL PRACTICE

Safety Rules—Electrical Work*

(1) Power feeders above 250 volts shall be handled with great care, as carelessness may cause a fatal accident. Such systems should never be worked upon outdoors when live, during rainy or damp weather, and otherwise only with the approval of the electrician.

(2) The 250-volt direct-current power circuit under ordinary conditions is not likely to cause death by shock; but the same precautions should be observed in handling this circuit as in handling those of higher voltage, not only to avoid possible injury from shocks and burns, but to form habits of precaution in handling wires. Remember that it is possible to receive a fatal shock from a 125-volt circuit under certain conditions.

(3) So far as possible, treat all circuits as though they were live, even though you believe them to be dead.

(4) Never handle electric wires while standing or sitting in a wet place, without extra precaution to obtain insulation from the ground.

(5) In handling any circuit known to be live, whenever possible, use only one hand. It is best to keep the other hand behind the back. The most dangerous shocks are those from hand to hand.

(6) When working upon live circuits, take care to work upon but one wire at a time and properly insulate yourself from the ground and from other wires of the circuit. Insulate each joint as it is made before starting on another wire. Be sure you are properly protected from falling from a high position in case of shock. Careless haste in working on live circuits is the cause of most accidents. Be cautious and alert at all times and under all conditions.

(7) The insulation on electric wires cannot be depended upon to protect you from shock. Avoid working upon any live circuits as much as possible.

(8) Never close a switch without full knowledge concerning the circuit and why the switch was opened.

(9) When an electrical worker is engaged at pole work or other overhead work, he should wear a belt and safety strap.

(10) Tape the handles of your tools, to assist in preventing short-circuits across them.

(11) If you see any person handling electrical apparatus who has no right to do so, stop him at once and report the matter to his foreman.

(12) If you see any electrical equipment in unsafe condition or improperly operated, correct the conditions or report the matter to the proper foreman.

(13) There are many special conditions which make electrical work dangerous. Even telephone or signal wires may become crossed with high-tension wires and become dangerously charged. It is not possible to explain in detail all such possible cases, but competent workmen are always afraid.

(14) Never look at an intense arc without adequate protection, such as heavy blue or black glasses. Intense pain results from exposure of the delicate nerves of the eyes to the intense light of the electric arc. As this pain does not manifest itself until several hours afterward, you should immediately seek the advice of the doctor, if you have so exposed your eyes, in order to avoid suffering.

(15) When you complete a job, never leave tools or material overhead and always replace safeguards.

(16) You must have the switch open when working on a lamp.

(17) Do not throw or leave pieces of carbon where a person is liable to step on them and lose his footing.

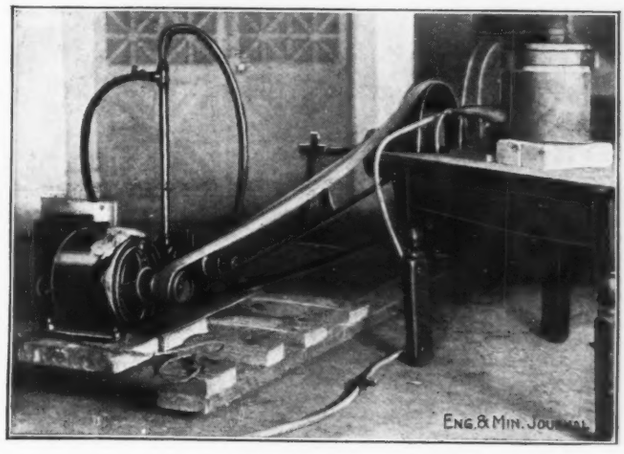
(18) Carefully inspect wires, ropes, arms, etc., when trimming lamps and report defective conditions immediately.

*From Inland Steel Co.'s book of rules.

Portable Blower Set

By Stephen L. Goodale*

The metallurgical laboratories of the School of Mines of the University of Pittsburgh were not provided originally with piping for compressed air. Many occasions



Portable Blower Set

have arisen for using small amounts of air at a few ounces pressure in different parts of the department and I accordingly had the portable set made up as shown in the photograph. A ½-hp. motor drives the countershaft, which is belted to the blower, the pulleys being chosen to drive the blower slightly above its rated speed of 450 r.p.m. A Crowell No. 2 rotary, positive-pressure blower with inlet and discharge of ¾ in. is used. From the short vertical discharge pipe two lines of ½-in. hose are taken, so that two Fletcher furnaces may be run at once, and sufficient air may be obtained for a number of blast lamps. The platform is set on ball casters at the corners, which make it easy to run about on our concrete floors. The stringers of the platform as shown in the photograph are too springy, and we have been obliged

*Colorado Springs, Colo.

to shorten them for stiffness; before they were shortened it became necessary to place a little block under each stringer to give it a bearing on the floor at the center. This size blower does well for its present uses, but the next size larger would be better for most laboratories.

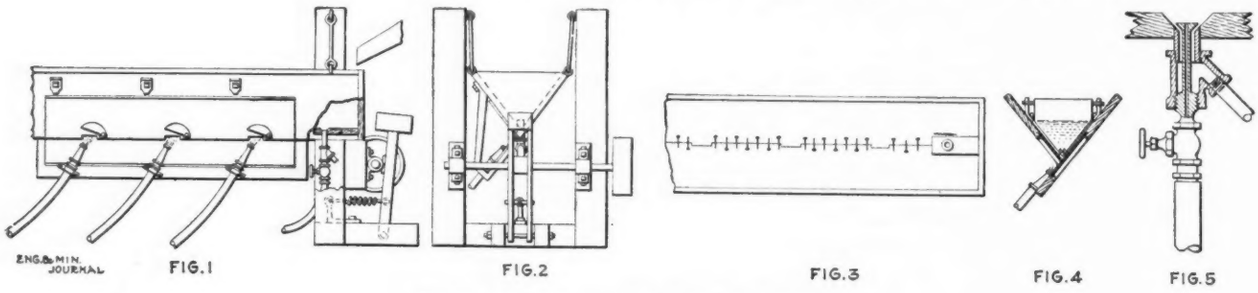
Some months ago considerable difficulty was experienced in getting a temperature in our small furnaces to melt copper. This was due to poor gas and was overcome by blowing the air through an iron pipe leading through a Hoskins electric combustion furnace. By this means the air was heated to something over 200° C., and the temperature readily attained. Under ordinary conditions when our gas is good, this expedient of heating the air is not necessary.

Concentrating Launder

A launder devised for the purpose of concentrating thin material or pulp has been designed by Philip R. Stanhope, of Denver, Colo., and patented under U. S. pat. 1,029,080. A V-shaped launder is provided having a hydraulic ore-agitating mechanism as described. The launder has its feed end closed by a board and a chute is arranged to discharge the pulp from a stamp or other crushing mill into the feed portion of the launder. A strip of wood is fastened along the bottom of the head portion of the launder for a short distance, in order to form a connecting support for one end of the vertical pipe nipple, shown in the drawing, which is extended up through an aperture formed in the angular bottom edge of the launder, into an aperture formed in the strip to receive it. A Y-pipe fitting, shown in Fig. 5, is secured to the lower end of this nipple, with its adjacent apertures depending from the nipple, and a valve stem is threaded to the vertical entrance to the Y, extending through it and the nipple to its upper end, where it is provided with an inverted conical head that forms a valve. The top edge of this nipple is provided with a beveled edge opposite to the bevel of valve, and the space between the end of the nipple and around the sides of the valve forms an entrance passage for the settled mineral particles, which work down into the body of the nipple, into and through the passage into the other portion of the Y-fitting, and out through a discharge pipe that is threaded to its end, through which it flows and discharges to a storage bin. This valve stem can be moved up or down by turning it in its thread in the end of the Y, to increase or decrease the size of the mineral inlet into the pipe nipple. The opposite end of the valve stem is threaded and a handwheel valve is connected to it. A nipple is connected to the opposite end of the handwheel valve, and a hose is connected to the nipple. This hose extends to a supply of clean water under pressure, which when the handwheel valve is open, flows through the stem into the bottom of the launder.

From the end of the strip, before mentioned, the bottom of the launder is V-shaped throughout the rest of its length, which may be any convenient dimension. In opposite sides, close to its bottom, rows of nails, shown in Fig. 3, are driven a portion of their length, leaving the remainder of the nails projecting from the inside of the trough, forming riffles, which are placed to stand out the same distance and are arranged so that they intermesh with each other but are separated from each other by a small space.

At predetermined distances apart along the length of the launder, concentrate-discharging apertures are placed, which may be of any desired form. They are arranged to discharge onto an apron that extends from the bottom edge of the launder at such downward angle as will permit the concentrate to wash across the apron. This apron usually consists of a board that forms a continuation of the board that forms the opposite side of the launder from these outlets, and is preferably covered at a point adjacent to the outlet with a piece of sheet iron. Water-discharging nozzles, shown in Fig. 2, are placed on the apron in such a way as to deliver jets of water into the concentrate-discharge openings. These nozzles deliver water under pressure and are flattened. The concentrate-discharge openings are provided with gates by means of which they may be opened or closed as desired.



DETAILS OF CONCENTRATING LAUNDER

This concentrating launder is suspended by rods from timber frames, which are placed at opposite ends, the rods being connected at one outer end to eye-bolts which are in turn secured to the inside of the timbers and also to eye-bolts at their opposite ends that are attached to the tops of the opposite sides of the launder. The head of the launder is provided with a bumping or jarring mechanism in order to impart blows against the end of the launder, this arrangement being shown in Fig. 1.

The launder is provided at intervals along its length with slime-catching devices, which consist of pieces of carpet or other suitable fabric which are arranged to hang from a rod that is vertically adjustable in brackets that are secured to the opposite side of the inside of the launder. The carpets are to be removed, from time to time, and thrown into tanks of water for cleaning. The accompanying drawing gives an idea of the construction and operation of the device.

A Loose Piston Ring Can Be Tightened by Peening, if it is narrower than its groove, according to "Power," Apr. 1, 1913. The effect of thus peening with a hammer on opposite sides in a staggered relation, is to make the ring slightly crooked laterally and so to bear tight against the sides of the grooves.

THE COST OF DOING THINGS

Iron Mining in Minnesota

The following data were taken from Bulletin No. 1 of the Minnesota School of Mines Experiment Station. For prospecting on the Mesabi with diamond drill, it is stated that a typical outfit costs about $2500, exclusive of diamond investment. It consists of: Sullivan diamond drill "H," 1000 ft. capacity; No. 5 Cameron pump; Evred-model churn drill; vertical dry-top boiler, 20 hp. (extra-heavy pattern on account of the hard usage to which it is subjected); string of tools, drill rods, 200 ft. of 3-in. and 500 ft. of 2-in. casing, and a 30-ft. derrick or tripod. The large drilling concerns have a heavy carbon investment. Stones range from four to nine carats; medium stones from four to five carats are preferred. The price of carbons is about $90 for choice stones. The wages drawn by diamond-setters is about $118 a month and a competent man sets from five to six bits in a 10-hr. day. In hard seamy rocks, two bits are usually needed per drill shift. Reaming consumes on an average 1½ hr. per drill shift. A log of a 1633-ft. hole drilled in the Vermillion Range from an underground position shows a cost of about $3.25 per ft. made up of $0.80 labor and $2.45 for supplies. The diamond wear, included in the supplies, was approximately $1.85 per ft. This was a $\frac{15}{16}$-in. hole through greenstone and was drilled in 131 actual shifts during 94 calendar days. This indicates a rate of 12.4 ft. per shift. Stones are used until they are reduced to ⅛ carat or less, and it is stated that available data covering several thousand feet of drilling indicates that the average cost of diamond wear is about $1.50 per ft. drilled. In regard to rate of drilling, 8 to 20 ft. per shift is given for hard slate. 5 to 15 ft. in quartzite and decomposed taconite, and 6 to 10 ft. per shift drilling in hard taconite. The actual cost of churn drilling is stated to be from $1.75 to $2 per ft. with $3 to $3.50 for diamond drilling. These costs are obtained, however, by large operators.

Remarks on operating estimates are quoted in full:

When a property has been drilled and estimated, the engineer makes further estimates to determine the method of mining best suited to the orebody under consideration. The following basis has been established for comparison of underground and openpit mining costs:

TABLE NO. 1

Stripping ordinary glacial drift, 30c. per cu.yd.
Stripping ordinary paint-rock, 30c. per cu.yd.
Stripping ordinary broken taconite, 75c. per cu.yd.
Stripping ordinary solid taconite, $1 per cu.yd.
Steam-shovel mining, ordinary ground, 15c. per ton.
Underground mining, ordinary conditions, 75c. per ton.
One cubic yard of ore is roughly two tons.

Sometimes a glance at the ore estimate will suffice to classify part or all of an orebody. Often a calculation must be made as exemplified by this case: A drill hole shows 50 ft. of ordinary glacial drift and paint rock, 15 ft. of hard taconite, 36 ft. of merchantable ore. All other things being equal, is this an openpit or an underground proposition? Reduce the consideration to a column of one yard square at drill hole, a comparison may be made, using the data in Table No. 1.

Underground Mining:		
Cost of mining a column of ore 1 yd. square and 36 ft. high at 75c. per ton (1 cu.yd. = 2 tons), $^{36}/_{3} \times 2 \times \$0.75$ equals		$18.00
Openpit Mining:		
Stripping a column 1 yd. square and 50 ft. high of glacial drift at 30c. a yard, $^{50}/_{3} \times 30$c.	$5.00	
Stripping 15 ft. of solid taconite, at $1, $^{15}/_{3} \times 1$	5.00	
Steam-shovel mining at 36 ft., ore at 15c. a ton, $^{36}/_{3} \times 2 \times 15$c.	3.60	
Total cost of openpit work		$13.60
Difference in favor of openpit work		$4.40

The figures given in Table No. 1 may be reduced to vertical depth for one yard square and stated as follows:

TABLE NO. 2

Cost of stripping glacial drift, 10c. per ft. of depth.
Cost of stripping ordinary paint-rock, 10c. per ft. of depth.
Cost of stripping broken taconite, 25c. per ft. of depth.
Cost of stripping solid taconite, 33⅓c. per ft. of depth.
Openpit mining, 10c. per ft. of depth.
Underground mining, 50c. per ft. of depth.

It is understood that such questions as adverse or favorable topography, accessibility of dump room, quicksands, swamps, etc., have a special bearing on each individual case that does not admit of generalization. The economical limit of stripping is at present considered to be within the following proportions:

1. One yard of overburden to one ton of ore.
2. Not to exceed 2-ft. depth of overburden to 1 ft. of ore. Hard slates and taconite cost two or three times as much as ordinary glacial drift and it is customary when applying these figures to consider one foot of such material as three feet of overburden.
3. A maximum stripping depth under any consideration of 150 feet.

British Columbia Copper Co.

During the 4-yr. period, 1909-1912, the British Columbia Copper Co. according to its annual reports has produced 34,560,255 lb. of refined copper as follows: 6,325,000 lb. in 1909, 7,143,456 lb. in 1910, 9,944,987 lb. in 1911 and 11,146,811 lb. in 1912. The operating cost as reported, after deducting gold and silver, was 9.82c., 9.04c., 11.63c. and 12.85c. respectively. A study of the financial statement, however, shows that the net income after paying for plant additions, lands, etc., was approximately 1.46c. in 1909, 0.785c. in 1910, 0.4c. in 1911 and 0.734c. in 1912 per lb. of copper. Based upon the average price reported received for copper gives a dividend cost of 11.62c. for 1909, 12c. for 1910, 11.9c. for 1911 and 15.93c. for 1912. The cost per ton of ore including, all charges from ore in place to marketing as reported, was: $2.63, $2.68, $2.73, $2.88 and $2.45 from 1908 to end of 1912 in the order named.

Cost of Complete Concrete Structures

The accompanying table gives the costs of various types of concrete construction by specific example, selected from a list in Taylor and Thompson's "Concrete Costs."

PARTLY DISTRIBUTED COSTS OF VARIOUS CONCRETE STRUCTURES

Description and Dimensions	Rate of Labor per Hour or Day: Laborer	Carpenter	Engineer	Miscellaneous Costs	Form Cost: Labor	Total	Proportions of Concrete	Materials Cost	Concrete Mixing and Placing Cost	Quantity Cu.Yd.	Steel Cost: Material	Bending and Placing	Total	Total Cost
Engine foundation	$0.25	$0.30		$0.78	$0.55		1 : 2 : 5	$4.00	$0.90	95	....	....	....	$7.20
Office foundation	1.75	3.50	$3.75	0.98	0.98	$1.21	....	3.76	1.05	271	....	....	....	*a* 6.80
Engine foundation	1.50	2.50	....	0.20	0.38	0.50	1 : 3½ : 6	2.51	0.92	350	....	....	....	4.13
Tank foundation, 75,000-gal. tank on six-post steel tower	....	....	....	0.42	0.18	*b* 0.18	1 : 3 : 5	5.86	1.27	105	....	....	....	7.73
Retaining wall, 16 ft. high by 250 ft. long	2.00	3.82	....	....	2.75	3.91	....	3.57	1.35	277	....	....	$2.02	*a* 12.03
Retaining wall, 8 ft. high	0.20	0.50	....	....	....	6.23	....	4.75	1.25	....	....	....	2.91	15.14
Car barn, 75x360 ft.	1.25	2.50	....	0.16	3.25	4.58	1 : 2 : 4	3.48	2.21	....	$0.91	$0.09	1.00	*c* 11.43
Irrigation tunnel, Calif., 6x7x1740 ft.	2.62	4.00	....	0.48	0.74	0.82	....	4.20	0.97	1500	....	....	....	6.47
Huntley irrigation tunnel, Mont., 9x9x375 ft.; top and sides, 8 in.; bottom, 6 in.	2.40	4.50	....	0.63	1.88	2.48	1 : 2½ : 5½	3.43	2.73	421	....	....	....	9.27
Belle Fourche irrigation tunnel, 8x8x306 ft.	2.30	....	....	3.44	0.58	1.08	1 : 2½ : 5	4.28	0.99	1505	....	....	....	*d* 9.79
Tunnel, 7x7x434 ft.; 6 in. thick	2.25	....	....	....	5.47	18.80	1 : 3 : 5	7.15	10.60	148	....	....	....	36.65
Gunnison tunnel, 11x12x31,000 ft.	3.00	....	....	0.21	0.67	....	1 : 2½ : 5	4.65	1.25	885	....	....	....	6.78
Core wall in dam, 1 to 25 ft. high; 3 ft. thick	1.75	3.50	3.75	0.65	0.17	0.31	....	3.76	0.93	1155	....	....	....	*e* 5.65
Dam, 120 ft. long	1.50	2.50	....	0.28	....	0.61	....	2.29	1.01	....	....	....	0.44	5.59
Concrete reservoir, 78x41 ft. by 12 ft. high	1.87	3.97	....	....	....	0.76	1 : 2 : 4	4.50	1.09	148	....	....	....	6.35
Concrete reservoir, 75,000-gal. slab roof	1.50	3.50	....	1.70	2.41	4.26	....	3.95	0.95	83	....	....	4.76	21.06
Concrete reservoir, 500,000-gal. 2 compartments 50x60 ft., each	2.75	3.50	....	....	....	2.96	1 : 2 : 4	7.85	1.72	710	....	....	4.96	19.55
Arch bridge, 20-ft. span	1.30	1.75	2.00	*a* 1.97	2.89	3.84	....	1.39	1.21	561	....	....	1.06	*a* 10.14
Arch bridge, 34-ft. span; 17-ft. rise	....	....	....	*a* 1.28	0.87	1.40	....	0.94	1.08	1804	....	....	0.15	*a* 4.09
Girder bridge, 25-ft. opening; 16-ft. roadway	....	....	....	....	....	2.72	1 : 2½ : 4	3.76	2.07	65	....	....	2.48	12.70
Girder bridge, 10-ft. span; 22 ft. wide	....	....	....	0.40	0.29	0.38	....	3.02	0.33	73	....	....	1.18	5.88
Sewer, 1400 ft. long, 30 in. in diameter	....	....	....	0.11	....	0.15	1 : 5	*f* 0.42	*f* 0.19	....	....	....	....	*f* 1.14
Pressure sewer, 24 in. in diameter	0.17½	....	....	....	*f* 0.12	*f* 0.23	....	*f* 1.12	*f* 0.37	....	....	....	0.34	*f* 10.25 *f* 2.22 *f* 8.25

a Includes superintendence.
b Old forms used.
c Includes all costs but supervision.
d Includes plant, depreciation, engineering, superintendence, etc.
e Includes equipment, depreciation, engineering and superintendence.
f Cost per linear foot.

Except where noted, the figures given refer to cubic yards of concrete, and do not include cost of plant, depreciation, repairs, superintendence or engineering.

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Comparative Costs of Haulage Systems

The accompanying table from an article by R. C. Warriner on the Crown Mines, Ltd. (Journ. So. Afr. Inst. of Eng., April, 1913) shows the costs of operating several different systems of underground haulage, the figures being those of the best month for each system. The power cost is comparatively insignificant, amounting to 0.16c. out of 3c. per ton in the case of electric haulage. For this reason the costs are not expressed on the ton-mile basis, as power would be the only factor seriously affected by a change in the length of the haul and ton-mile figures are, therefore, misleading. To show high economy, any system should be worked to its full capacity. In the case of the electric system in particular this maximum is not attained.

UNDERGROUND MECHANICAL HAULAGE COSTS

	Car Capacity, Cu.Ft.	Maximum Tons Handled	Average Length of Haul in Feet	Cost in Cents per Ton
Gasoline locomotive	64	23,054	2600	4.68
Main-and-tail	64	15,043	1380	6.62
Endless rope, No. 10 shaft	20	10,339	400	2.16
Endless rope, No. 3 shaft	20	20,666	650	3.78
Electric	230	108,031	2350	3.00

The gasoline locomotive and main-and-tail system are working under much more disadvantageous conditions than are the other systems. The main-and-tail system is installed in a haulageway with too many curves to permit its showing the best results. The endless ropes operate under the best conditions, in short, straight passages. For such conditions, they are probably the best system. They are not elastic and become complicated when there are changes in direction. For hauling large quantities over long distances from separate points, the electric system is probably the best. The gasoline locomotive furnishes the most elastic method of all.

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Nevada Hills

The Nevada Hills Mining Co., Fairview, Nev., in its annual report for nine months ended Dec. 31, 1912, shows that 29,984 tons of ore were treated at a cost of $9.64 per ton for operations, $2.60 for losses in tailings and 11c. for construction, total $12.35, less a credit of 15c. for miscellaneous earnings, leaving a net operating profit of $14.64 not including depreciation. The operating cost was made up as follows: $3.83 for stoping and development, 12c. for moving dump ore, $3.07 for milling, $1.03 for marketing products, 71c. for general expenses, 63c. for interest, 21c. for bullion tax and 4c. per ton of ore for property tax.

Development work made up 54% of the mining cost. The total cost of production was made up of 54% for labor, 35% for supplies and 11% for power. The mining expense consisted of 68.2% labor, 25.2% supplies and 6.6% power; compared with 35.2% labor, 47.6% supplies and 17.2% power for milling. The development work performed during the period amounted to 5866 ft. at an average cost of $10.56 per ft. or 4553.5 ft. of drifts and crosscuts at $9.77 per ft., 1253 ft. of raises at $12.50 per ft. and 59.5 ft. of winzes at $30.03 per foot.

Rare Minerals at Broken Hill, Rhodesia

By George D. Hubbard*

SYNOPSIS—Description of rare and beautiful minerals found in Rhodesia in association with a deposit of animal bones. Most of these minerals are phosphate combinations which are rare on account of the scarcity of phosphates in ordinary rock. Hopeite was formerly only known near Altenberg, Germany, while tarbuttite is found for the first time.

In 1902, there was discovered by accident both lead and zinc ores at Broken Hill, Northwest Rhodesia, South Africa, a point on the Cape to Cairo railroad, about 300 miles northeast of Victoria Falls, on the Zambezi River.

Mineral in a Series of Kopjes

The country is generally level, apparently a peneplain made by stream erosion and weathering through ages. The country rock is mostly limestone, but there are beds of sandstone both coarse and fine. Above the general level of the land rise small sandstone ridges, whose resistance is slightly greater than the limestones so that they stand a few feet higher. Beside these sandstone ridges are a series of kopjes, or small rugged hills, which seem often to be ore residuals still standing above the plain. They are not entirely of ore but contain limestone badly weathered, clay, other waste and residual material, and occasionally caves are found containing bone breccia and travertine. Some of these hills rise 75 to 90 ft. above the plain, are 300 ft. in diameter and more or less circular or irregularly rounded. The minerals are mostly the so called calamine, a hydrous zinc silicate sometimes called hemimorphite, because of its hemimorphic crystals, and cerussite, lead carbonate, with a considerable variety of minor minerals. Cerussite occurs in the unusual stalactite form in small crystals. Limonite, or hydrous oxide of iron, occurs mixed, in places, with white opaque quartz or flint. The quartz is probably transported material as no quartzite exposures or veins of quartz are known. Moreover, the quartz is in chips, fragments and splinters; and in caverns in some of the kopjes are implements of a crude sort both of quartz and of a close-grained reddish stone, together with bones both crude and fashioned. Bones of many animals were found but no human fragments.

Rare Minerals among Bones

Among the less common minerals are the following: Smithsonite, a hydrous zinc carbonate, descloizite, a hydrous vanadate of lead and zinc, rare so far as other localities are concerned, but found here in large quantities. Tons of it were thrown on the dump before its nature and value were appreciated. It forms cavernous masses mixed with limonite. Vanadinite occurs in the muddy mixture of bones and clay in considerable quantities, and almost always on the more abundant mineral, hopeite, which will be mentioned later. Vanadinite is a light brown, more or less massive mineral in botryoidal masses and consists of lead vanadate and lead chloride.

Pyromorphite is isomorphous with the last, i.e., its composition is in accord with the same general formula but differs in one or more elements. It consists of lead phosphate and lead chloride, occurs with limonite, with tarbuttite, also referred to later, and less frequently with descloizite, and presents small prismatic, pale-green or yellow, six-sided crystals in masses or in loose aggregates. Hydrozincite is a hydrous zinc carbonate and occurs sparingly with the hemimorphite in white, opaque, earthy, masses or encrusting tarbuttite pseudomorphs after hemimorphite. Wad and possibly psilomelane, two earthy manganese oxides, occur with limonite and tarbuttite.

Galena and sphalerite, the sulphides of lead and zinc, respectively, are found occasionally in the bone clay and may here be formed in place by the reducing action of the organic matter. All the secondary minerals mentioned above as well as those to follow have, most likely, been derived by alteration of these sulphides. But any such body of sulphides must lie at greater depths and is as yet unknown. Traces of copper have been found in a few of the minerals, but no mineral of that metal has yet been seen.

Hopeite Formerly Known in but One Place

Beside these more or less ordinary minerals, mentioned above, several otherwise rare, very interesting compounds are found here, and some of them in abundance and great perfection for minerals of such general rarity.

The first of these is hopeite, a hydrous zinc phosphate formerly known in but one place, a zinc mine near Altenberg, Germany, where crystals were collected in 1820. None has been reported since, either from this locality or from elsewhere, until South Africa contributed its treasures. A little of the mineral was made artificially many years ago.

In the Rhodesian kopje No. 1, nearly every specimen of the bone breccia is encrusted with hopeite in beautifully brilliant, water-clear crystals of all sizes up to about a centimeter in length. Some are single, some in showy clusters, and all associated with vanadinite. Quoting from L. J. Spencer's account of them in the *Mineralogical Magazine* for April, 1908, p. 5, "The hopeite crystals rest upon vanadinite or upon a thin yellowish-white crust which coats the surface of the bone breccia. This crust averages about ¼ mm. in thickness and usually consists of two layers, a lower one of finely fibrous hemimorphite, and an upper one of very minutely crystallized tarbuttite, hemimorphite, or calamine or of all three mixed together. On some specimens of this type the more distinct crystals of hopeite are associated with minute tufts of colorless needles of hopeite. Similar tufts of acicular hopeite were also found in some of the cavities of the bone breccia and inside bones and teeth."

"Other speciments, of a rather different type, consist wholly of a close aggregate of hopeite crystals with little or no matrix and no associated minerals. These masses of pure hopeite are of considerable size and may weigh several pounds."

Optically, hopeite is of two dimorphous varieties arranged in the same crystal, in alternate laminæ. The two varieties, identical in composition are distinguished

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as *A*-hopetite and *B*-hopetite. Its chemical formula may be written $Zn_3P_2O_8.4H_2O$.

Parahopeite, a new mineral, occurs sparingly but more frequently than hopeite was known to occur until this Rhodesian deposit was found. Its composition is the same as hopeite but its sp.gr. is 3.31, while that of hopeite is 3.01. It crystallizes in the triclinic system, while hopeite is orthorhombic. It yields its water only at higher temperatures than hopeite, as follows:

Degrees C	113	139	163	201	233	Red Heat
Parahopeite.....	nil	nil	1.9	11.6	15.5	15.8% H_2O
Hopeite.....	1.6	9.2	10.1	10.6	13.5	16.2% H_2O

Tarbuttite is a second new mineral, known to science from this place only and named in *Nature,* 1907, p. 215, for the first time. It is found in great abundance, and large beautifully crystallized specimens are not rare. It occurs as an incrustation on limonite, or associated with descloizite or pyromorphite. It is found as a pseudomorph after descloizite, hemimorphite, smithsonite, also as an incrustation over bone breccia in two of the hills or kopjes. Tarbuttite is a basic zinc phosphate corresponding to the formula $4ZnO.P_2O_5.H_2O$ or $Zn_3P_2O_8.Zn(OH)_2$. This is the first basic zinc phosphate ever seen either natural or artificial. Crystals are brilliant and colorless to pale yellow, brown, red, or green. The mineral is triclinic.

Rare Minerals Accounted for by Presence of Bones

The occurrence of so many rather unusual minerals and especially the phosphates may be accounted for by the presence of the bones of the breccia. These bones are from various animals of which some 20 species have been differentiated. All are recent. They seem to have accumulated in these caves, probably in part by the agency of man, at various intervals. And between periods of bone accumulation, clay and other débris gathered over them. Some cementation has taken place and the mass in parts nearly fills the entire cavity. Not all the minerals were formed at the same time. The hemimorphite or calamine and tarbuttite seem to have been the first to form over the bones and bone breccia; and then upon this incrustation came, the vanadinite, hylrozincite and more tarbuttite, and finally hopeite and parahopeite. The last two, and to some extent possibly the vanadinite are forming today. Phosphate-bearing solutions are depositing material derived from the first alterations, in tufts and groups of crystals of hopeite over all earlier crystals. Of course, all the minerals mentioned are of recent origin because they are found over bones of recent animals. The solutions now building the hydrous-phosphate crystals undoubtedly came through the bone breccia and there derived their phosphorus. Precipitation begins at once. In cavities in the bones and teeth, in cavities in the breccia; and over the outside of many bones, the beautiful newly formed crystals may be seen.

Rare Materials May Be Encountered Elsewhere

While zinc and lead orebodies are not usually associated with bone beds from which phosphates can so easily be built up, they do occur in limestones many times. And limestones often carry shells, bones, teeth, etc., which contain phosphates. Hence it would not be strange if phosphates of zinc and lead should be found in some other localities where they are yet unknown.

Several phosphates of zinc not yet found in nature have been made in laboratories. Among them may be mentioned one anhydrous salt $Zn_3P_2O_8$ in rhombic prisms, and an acid hydrous phosphate $H_4Zn_2O_8.2H_2O$ in large triclinic crystals. These are distinct types from any of the phosphates yet found in nature. How long will it be until in some other locality some of the new Rhodesian minerals will be found? And how long until some of those possible, but never yet seen native, will come to light?

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Michigan Mining Lawsuits

By P. B. McDonald*

A number of unique court cases have recently arisen in the iron regions of Michigan, both among individuals and mining companies, involving ownership in contested ore lands, verbal agreements made years previously, alleged misrepresentations, etc.

A year ago the U. S. Circuit Court of Appeals ordered George Maas, of Negaunee, to convey to his aunt, Mrs. Margaret Lonstorf, of Milwaukee, a one-sixth interest in the fee of valuable iron-ore lands at the Negaunee mine, because Maas in buying his aunt's interest several years previously for $100,000 had withheld important facts concerning the land from her.

A few weeks ago the State Supreme Court reversed the decision of Judge Cooper in the lower courts, and granted to J. H. Quinn, of Ishpeming, half the interest in the fee or royalty of the Tully mine, held by Tully, of Iron River, because of a verbal agreement made in 1902 between the two men when they examined the Baker and Tully ore lands in the Iron River district for promotion purposes. Tully claimed that the agreement applied only to the Baker land, in the fee of which he gave Quinn a half interest, but the court ruled that the preponderance of evidence showed that both properties were meant to be included in the agreement.

A somewhat similar verbal agreement is now in court, involving Col. Eugene Zimmerman, of Cincinnati, part owner of the Zimmerman mine, at Iron River. He is being sued by Paul Schook, of Crystal Falls, who claims that in 1906 Zimmerman came into his place of business, stated that he was looking for a mine, and agreed to "whack" with Schook if the latter secured him one. Schook was instrumental in securing for Zimmerman an option on the Kinney land, at Iron River, now the Zimmerman mine. Col. Zimmerman denies the agreement to "whack," but states that he would like to "whack Schook."

A case followed with interest by many fee owners of iron-ore lands, who leased their property at low figures in early days, but now wish they had stipulated higher royalties and minimum rentals, was the Young case, at Iron River. In 1901, Andrew Young gave a lease on land owned by himself in the Iron River district to the Verona Mining Co., a subsidiary of Pickands, Mather & Co. The lease was for 50 years, and called for a royalty of 10c. per ton on all iron ore removed, and a minimum rental of $1000 per year whether any mining was done or not.

In those days these were fair terms for the Iron River district, which was not considered especially favorable

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territory. Exploration on the land has since shown a small orebody not considered large enough to mine, although the company still holds the lease by paying $1000 per year. Young wished to have the lease cancelled, as the property is now much more valuable than formerly, if only for surface rights. Judge Flannigan denied Young's petition, stating that, although the terms of the lease do not suit Young now, they did in 1901.

The latest case to attract the attention of mining men has been started by the filing of a bill in circuit court, asking that a quitclaim deed, granted by Father Mtynarczyk, a former Catholic priest of Iron River, to Constancy Zyskowski in 1908, be set aside. The land in question is now part of the Davidson mine, of the Davidson Ore Mining Co., a subsidiary of the New York State Steel Co., and is known to contain several million tons of iron ore; the tract is 40 acres, described as the N E ¼ of N W ¼ of Sec. 23, 43-35. In 1895, Father Mtynarczyk sold the land to Zyskowski, but reserved the mineral rights for himself, a few months later leaving Iron River for the East, being now a resident of Ohio. In January, 1908, the priest received a letter from Zyskowski representing that the reservation of minerals made in the deed constituted a hindrance to his being able to dispose of the property; that the reservation was of no value because no ores existed upon the land; and that if the priest would give him a quitclaim for the mineral rights, Zyskowski would send him $25 for his trouble. This the priest did and received the $25.

However, Father Mtynarczyk now claims that previous to the securing of this quitclaim, Zyskowski had given an option to Michael Gleason, to explore the land for iron ore, the date of the option being Aug. 21, 1907; also that Gleason advised and conspired with Zyskowski to get the quitclaim to the mineral, and that soon after the quitclaim was secured, Gleason started exploring the land and succeeded in finding enough ore so that on Oct. 8, 1908, he assigned his option for a lease to the Gleason Exploration & Mining Co. A large orebody is known to exist on the property, estimated at several million tons. The operating company, the Davidson Ore Mining Co., took a lease for 30 years from the Gleason company in June, 1910. The Davidson company pays the Gleason company 35c. royalty on every ton of iron ore removed and pays 15c. per ton to Zyskowski and associates; with $12,500 per year stipulated as the minimum royalty whether any mining is done or not. It is also rumored that the Gleasons received a bonus of $80,000, when the Davidson company took over the lease.

California Oil Pipe Lines

By Lewis H. Eddy

By an act of the legislature passed May 7, 1913, oil pipe lines in California were made common carriers and subject to the control of the railroad commission under the provision of the Public Utilities Act approved Dec. 23, 1911. The new act provides that every corporation and every individual or association owning, operating, managing, or controlling any pipe line or any part of any pipe line, plant or equipment, within the state for the transportation of crude oil or the products thereof, either directly or indirectly, to or for the public, for consideration of any kind, is declared to be a common carrier and subject to the law governing the railroad commission. The law applies to such pipe lines as are constructed, operated or maintained on the right-of-way of any railroad corporation or other common carrier required by law to transport oil.

The law applies also to the ownership, use, operation, management or control, directly or indirectly, or by participation under lease, contract of purchase, agreement to buy and sell, or any other contractual or tacit agreement or arrangement of any pipe line, plant or equipment, or pipe-line system for the transportation of oil, operating within the state, whereby there may be secured control or monopoly of the purchase or transportation of oil. Corporations organized for the purpose of acquiring, constructing, leasing, owning, maintaining or operating any pipe line with pumping stations or other equipment or plant, constructed and maintained or to be constructed or maintained for the transportation of oil, are included in the act. It is provided that if any section or any part of a section of the act is for any reason held to be unconstitutional, such decision shall not affect the validity of the remaining portion of the act. The provisions of the act are not to be construed as applying to any corporation, individual or association, where the nature and extent of the business is such that the public needs no use in the same, and the conduct is not a matter of public consequence.

Ray Consolidated Copper Co.

The report of the Ray Consolidated Copper Co. for the first quarter of 1913 shows that the total production of copper in concentrate was 12,369,696 lb., composed of 3,869,006 lb. produced in January, 4,077,818 lb. in February and 4,422,872 lb. in March.

There were milled 537,205 tons, of which 62% was from territory tributary to No. 1 shaft, 37% from that tributary to No. 2, and 1% tributary to No. 3 shaft. Of the tonnage produced, 14% was from development work, 35% from active stopes, and 51% from drawing reserve ore already broken.

The average grade of the ore was 1.739% copper, and the average mill recovery 66.205%. Total concentrate recovery was 33,869 tons, containing an average of 18.26% copper, corresponding to a ratio of concentration of 15.86 tons of ore into one ton of concentrate.

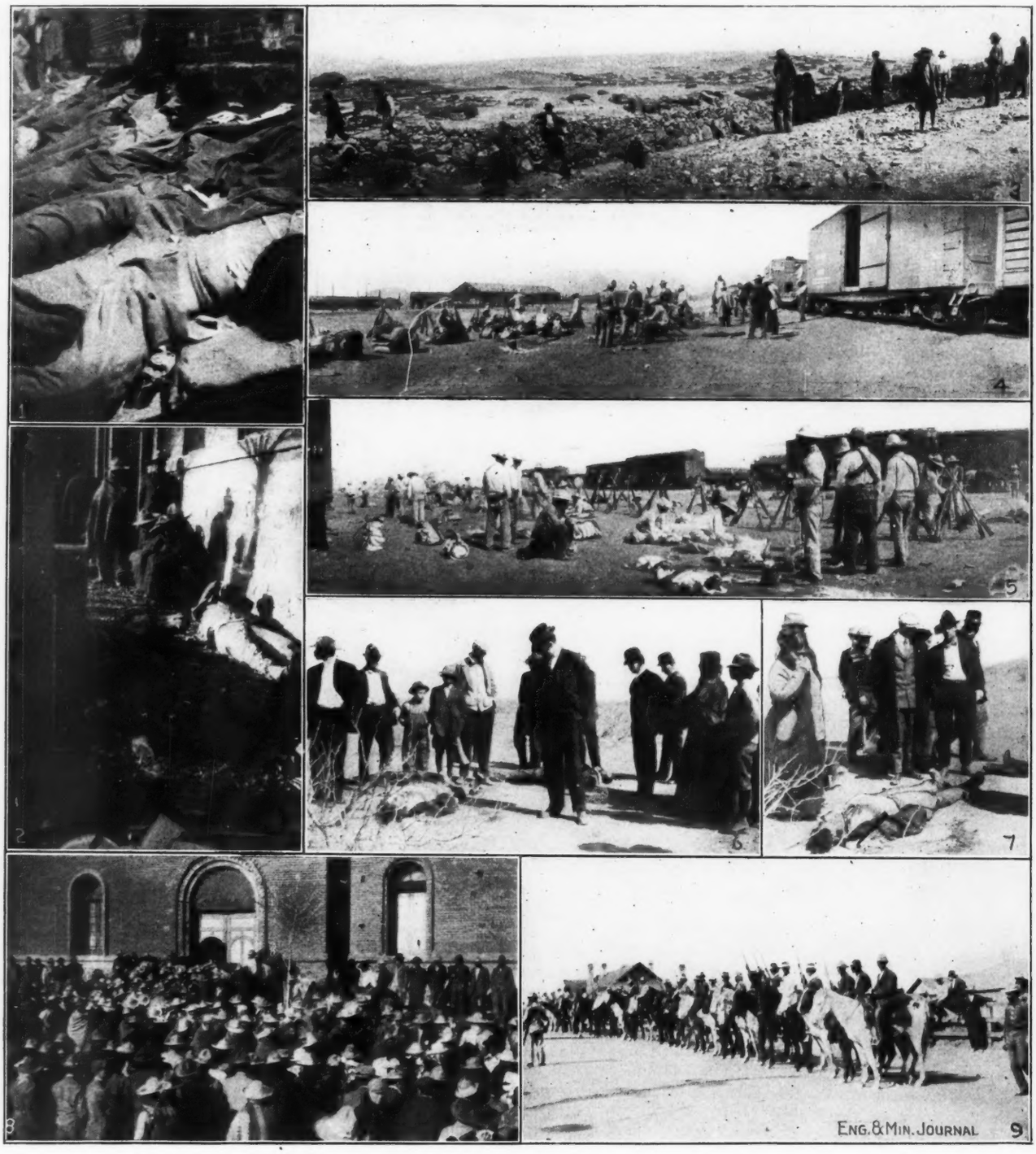
Copper cost 9.5096c. per pound to produce, after allowing for smelter losses and applying the Ray & Gila Valley R.R. dividends as a credit to cost. Operating profit amounted to $678,874 for the quarter and miscellaneous income was $5751, making total profit for the quarter, $682,625. Earnings are based on 15.1513c. received for each pound of copper.

Underground development for the quarter amounted to 21,651 ft., and the mining cost, including all fixed charges, but not the charge for extinguishment of mine development account, was 72c. per ton. The milling cost was 46.479c. per ton.

During the quarter, the seventh section of the mill was completed and for the last two months all seven have been in operation. Completion of the eighth section is expected during the coming quarter.

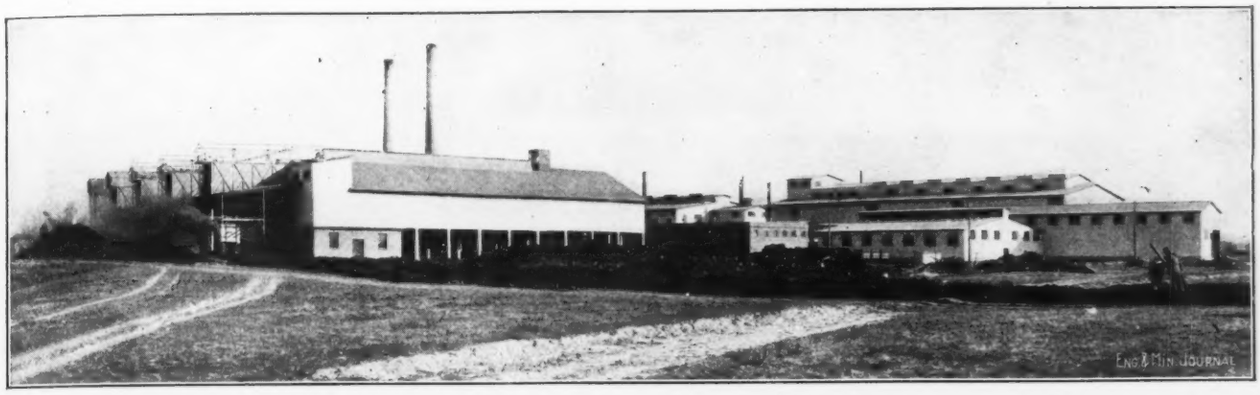
Kentucky Fluorspar Mines Shipped Galena Concentrates to the extent of 151 tons, with an average tenor of 70.2% lead, to smelters from the mines in 1912, according to J. P. Dunlop, of the U. S. Geological Survey.

PHOTOGRAPHS FROM THE FIELD



And Still Mexicans Cry, "Viva la Revolucion"

1. Dead federal troops in rear of Cananea arsenal after battle of Cananea, Mar. 26-29. 2. View of the arsenal, shortly after the battle of Cananea. 3. Federal fort at Cananea. At the left is the smelting works of the Cananea Consolidated Copper Co. An American, operating a machine gun in this fort, proved the backbone of the federal defense. 4. After the battle of Naco. Rebel troops camping just inside the international boundary line. 5. Constitucionalistas in camp after the capture of Naco. During the battle, the freight cars in the background were placed across railroad crossings to prevent stray bullets entering U. S. territory. 6. On the battlefield after the battle of Naco. 7. One of the dead after the battle of Naco. 8. Outside the arsenal of Cananea after its surrender. 9. Rebel cavalry shortly after the capture of Cananea.



PLANT OF AMERICAN ZINC CO., HILLSBORO, ILL.

NITRATE VATS, ANTOFAGASTA, CHILE

Photograph furnished by Harriet Chalmers Adams. Reproduction by permission of "Review of Reviews."

TIN INGOTS

These were produced at the Irvinebank Smelting Works, situated near Herberton, Queensland.

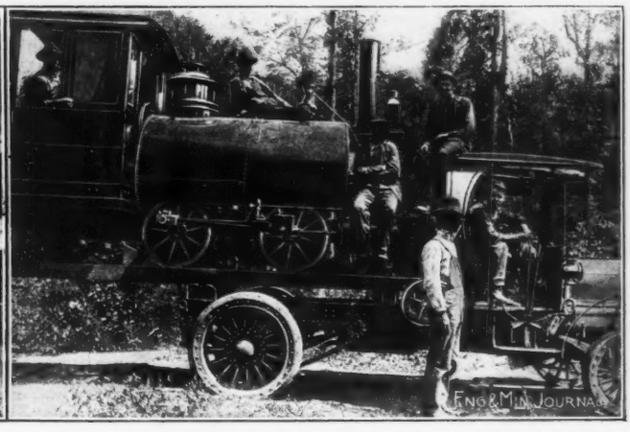
A 16-TON LOCOMOTIVE BEING HAULED BY 28 HORSES

EIGHT-HORSE TEAMS USED IN TRANSPORTING ORE CARS

A haul of 31 miles across desert and mountainous country was necessary to deliver engine and cars to Calumet & Copper Creek mine, Arizona.

DOWSING EXPERIMENTS IN FRANCE

Monsieur Probst, with his trusty hazel twig prepared to locate water, underground dry cavities, etc. Copyright Paul Thompson.



SAURER MOTOR TRUCK TRANSPORTING LOCOMOTIVE

The locomotive was hauled over 12% grades for nine miles to the plant of the Quenelda Graphite Co., Clay County, Ala.

Corrugated Roll Shells

By H. C. Holthoff*

Frequently crushing-roll shells used for fine crushing become corrugated and millmen are at a loss to find the cause. The direct cause for the faces of roll shells corrugating is abrasion. Without abrasion there can be no corrugating. Abrasion is due to two causes: (1) If the material fed is coarser than the rolls can nip without slippage; (2) if the roll faces are running differentially.

In all cases where corrugating occurs, it will be found upon close investigation, if the feed is not too coarse, that the diameters of the two rolls are not exactly the same, or, if they are, that the diameters of the driving pulleys are not the same. In fact, it is very rarely the case that the two shells or the two driving pulleys are exactly the same in diameter, for the reason that with the best machine-shop practice, it is impossible to turn two pieces to absolutely the same diameter without extraordinary care. Hence, it follows that there is a differential in the peripheral speed of the rolls, which causes abrasion and corrugating of the faces.

To insure the roll faces running in unison, the fixed roll should be driven with a pulley of ample diameter and face to transmit the full horsepower required when crushing. The movable roll should be driven by a smaller pulley with narrow belt of sufficient capacity only to move it when not crushing, depending upon the pressure between the roll faces for power when crushing. The friction between the roll faces, being enough to overcome the traction power of the small belt, causes it to slip when there is a difference in diameter of rolls or ratio of pulleys. With this method of driving rolls, the faces run in unison and do not corrugate, notwithstanding there is a slight difference in diameter of the shells.

Chilled-iron or manganese-steel shells are more likely to corrugate than those made of rolled steel. If the shells are made of low-carbon rolled steel, the quartz embeds itself in the crushing faces, making them rough. This adds to the friction between the faces and prevents slippage and abrasion, and for this reason they are much less liable to corrugate than shells made of chilled iron or manganese steel, which being hard become smooth and glossy on the crushing faces, thereby decreasing the friction and increasing the slippage and consequent abrasion.

During the last year, several manufacturers have brought out patented devices designed to give the fixed roll an end movement, varying from ¼ in. to 1 in. These devices are represented to give increased crushing capacity, and prevent corrugating of the faces of the roll shells. The correctness of the first contention, viz., that an increased capacity is obtained, is extremely doubtful and remains to be proved. The claim that end motion will prevent corrugating is absurd. If the peripheral speed of the two roll faces is not the same there will be more or less abrasion and corrugating will take place proportionately to the differential speed.

All these devices are more or less "trappy" and give trouble in their mechanical operation, besides adding materially to the power consumption and cost of upkeep, as well as first cost of the rolls.

The advantage claimed for crushing rolls with end-motion devices are mere "talking points," but they sometimes appeal to the engineer who has only a limited working or purely theoretical knowledge of the operation of crushing rolls. The oscillating device will not do what is claimed for it and there is no need for such an attachment if rolls are properly constructed and operated.

*Manager, Chicago plant, Allis-Chalmers Manufacturing Co., Chicago, Ill.

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The Copper Mines of Katanga

At the last annual meeting of the Tanganyika Concessions, Ltd., Robert Williams communicated much information, of which the following is a part:

The Union Minière Co. cannot hope to obtain coke at less than £5 per ton. The company is now erecting its own ovens, which will furnish coke at about that price. At the copper mines a concentrating process has been installed which yields about 80% of the total copper in the ore in the form of concentrates that are well suited for smelting. The single furnace of the smelting works has so far produced about 5000 tons of copper ingot. A second furnace has been erected, but can be used only as an auxiliary until the coke supply is increased. However, it is expected that during 1913 the two furnaces will be working together producing about 1000 tons of copper per month.

At present the company is producing copper at the rate of 5000 to 6000 tons per year and delivering it in Europe at about £42 per ton. A further extension of the smelting plant is being considered. The present ore supplies are obtained wholly from the Star of the Congo mine. The railway is now practically into Kambove and the mine there as well as the Luushia mine is being rapidly brought into a condition for supplying ore.

The Kansanshi mine of the Rhodesia Katanga Co. has yielded 2400 tons of copper, all of which has been obtained by smelting with charcoal and wood, and transporting everything over a wagon road of 80 miles. During the last dry season 404 tons of copper were produced and delivered on the railway for £32 per ton.

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California Oil Dividends for May

Oil stock dividends paid in May by companies listed on the stock exchange amounted to $810,606, according to the San Francisco *Chronicle*. This appears to be a small showing when compared with $1,396,611 paid in April, but several quarterly dividends were paid in that month. In May the California Oilfields, Ltd., sent to its shareholders in England $361,595. In June the Standard Oil Co., of California, will pay a quarterly dividend of $1,125,000. The following is the list of May dividends:

Amalgamated	$100.00	$1.00	$50,000
Amer. Pet. pfd.	100.00	0.50	8,255
Amer. Pet. common	100.00	0.33⅓	39,607
Bear Creek	1.00	0.025	17,100
Cal. O. F., Ltd.	.....	33%	361,596
Claremont	1.00	0.01	4,500
Dome-Pinal	1.00	0.01	4,000
Home (Coalinga)	1.00	0.01	10,000
Maricopa Queen	1.00	0.005	4,960
Mount Diablo	1.00	0.0075	7,500
New Pennsylvania	1.00	0.005	2,488
Record	2.00	0.05	10,000
Rice Ranch	1.00	0.01	3,000
S. F. & McK.	10.00	0.10	5,000
Sauer Dough	0.50	0.015	2,992
Section 25	1.00	0.50	20,000
State Consolidated	1.00	0.01	5,000
Union Oil	100.00	0.60	184,754
Union Prov.	100.00	0.60	91,403
United Petroleum	100.00	0.60	48,451
West Coast	100.00	1.50	15,000
Western Union	100.00	0.50	5,000
W. K.	1.00	0.02	10,000
Total			$810,607

CORRESPONDENCE AND DISCUSSION

Gold Recovery by Volatilization

In the JOURNAL of June 7, 1913, I notice an abstract of an article by Ben Howe on "Gold Recovery by Volatilization," which has been going the rounds of the technical press as something new.

Since the JOURNAL has also quoted Mr. Parmalee's discussion of the article, and stated that this method was worked out by Edwin C. Pohlé and me in 1897 and 1898, there is not much more to say on the subject. However, the volatilization of gold by this method was discovered by me as early as 1893, while experimenting on Cripple Creek ores at Aspen, Colo. After going to the Globe works in Denver in 1896, I found that Mr. Pohlé of that plant had made a similar discovery with silver ores, so we began to work out the method as stated.

Our work was published in full in the JOURNAL, Aug. 29 and Sept. 19, 1903, and is quoted in Rose's "Metallurgy of Gold." Our patents were taken out in U. S. and in all foreign countries where mining operations exist, and are noted in the JOURNAL of Oct. 31, 1903.

The process for gold ores, as described by Mr. Howe, is identical with our experiments. The size to which the ore is crushed, the type of furnace used, the temperatures maintained, the percentage of salt required, the method of condensing the fumes and collecting the gold and the character of the gold slime obtained, might easily have been taken from our note books.

We had no difficulty in collecting gold fumes in the manner described. Those of the base metals were more difficult to collect, but we succeeded in making a commercial recovery of all valuable metals or fumes in our experimental plant. The advance in metallurgy and in mechanical appliances since our work was done, together with a better knowledge of the character of the base-metal fumes would no doubt enable me to simplify and improve the process considerably at the present time.

STUART CROASDALE.

Douglas, Ariz., June 12, 1913.

Missed Holes

I notice that an editorial in the JOURNAL, May, 31, invites a discussion of missed holes. I have never attempted to dig out a missed hole; not that I think the process particularly dangerous, but I doubt the feasibility of removing all the powder, if the charge was properly rammed home. I know that I should hate to drill into such a partly cleaned hole.

The detection of missed holes is of great importance. About two years ago, in one of the mines of the Treadwell group, all of the blasting in the stopes was done at noon, then the men, on returning from lunch an hour later, knew exactly where to look for missed holes and loose ground. If any missed holes were found they were blasted immediately. In this way there was no possibility of a man's drilling into a missed hole on the next shift. At the same time, since the shift that did the blasting did the barring down, the chances of men on the succeeding shift blundering under loose ground were much diminished.

This system, of course, caused loss of time in clearing the stopes of men and hose, nor was the air improved thereby; but in these mines the air soon regained its purity, and the loss of time was counterbalanced by the increased safety.

In the mines at Goldfield where I have worked, the practice was for the machineman to examine the face on coming on shift; if he found missed holes, it was up to him not to drill into them, but to blast them all when going off shift; if he did not find them it was his own fault. Sometimes the cager would tell him as he came down, "so many reports short in such and such a place"; sometimes the cager would forget to tell him. When a machineman came off, he counted the reports he heard—usually from the safe position of the station; all of the other machinemen were doing the same; nobody really knew whose shots went and whose did not. What each man reported to the cager—if he reported anything—was more or less of a guess. In the last analysis it came down to each man looking out for himself.

MACHINEMAN.

Kellogg, Idaho, June 2, 1913.

[Firing in the middle of the shift is not uncommon and is satisfactory from the safety viewpoint. Where ventilation is poor, however, it may not allow time to clear out the gas. Our correspondent states a fact well known by practical mining men, that it is generally useless to count stope shots.—EDITOR.]

A Five-Ton Smelting Furnace That Smelts

In reply to the discussion of my article in the JOURNAL of June 7, I will say that Professor Jarvis is apparently endeavoring to prove that I have invented some new laws of chemistry. I will admit that the figures given are "startling," but no more so than the title of the paper itself.

Taking up the points of discussion in their order, we start with the volume of blast. The principal reason for running the blower at 400 r.p.m. was because the furnace ran faster, and, therefore, kept hotter, at this speed than at 300 or even 350 r.p.m. In fact, this reason was the only one, for when a man is operating a furnace with a green crew he has his hands full keeping things going, without spending his time delving into the realms of thermochemistry.

According to the calculations of Professor Jarvis, five times more air than was necessary was blown into the furnace; or, in other words, for the charge as given the blower should have been run at 80 r.p.m. I will defy the greatest metallurgist in the world to keep the furnace going 30 min. on that amount of air.

This part of the argument reminds me of a conversation I once heard between a tenant of a new office building and the contractor who had installed the heating system and was still in charge of the building. The office man said his room was not warm enough and demanded a larger radiator. "Nothing doing," replied the contractor, "I figured out the cubical contents of your room and have given you a 10-section radiator, which has the required radiation surface." "I don't give a —— what your figures are," shouted the tenant, "the fact remains that my office is cold."

Passing on to the heat balance sheet. I regret exceedingly that I had no pyrometer to record the temperature of the entering blast and the escaping gases, but I am positive the latter were nothing like 1200° F. As previously stated, the low blast pressure of the Partridge furnace causes the fusion zone to concentrate at and just above the tuyeres. The heated blast has the further effect of keeping this zone from climbing, for the temperature of the air does not have to be raised much before action commences. Passing on through this low zone of incandescence, the heat is, therefore, gradually absorbed by the successive ore layers above. By lengthening the ore column sufficiently a point is reached whereby the top is cool enough to bear the hand on it (as in lead smelting) and the heat lost in the escaping gases is almost negligible. It seems to me, therefore, that it is attacking the problem backward to start with the assumption that a certain number of heat units are going up the stack.

The heat generated in pyritic smelting consists of the following items: Combustion of C to CO_2; combustion of S to SO_2; oxidation of Fe to FeO, and combination of FeO and CaO with SiO_2. The two latter items have been ignored by my critic entirely, and I wish to emphasize the fact that the heat reaction of the charge under discussion was exothermic. Although an immense amount of heat was required to tear asunder the constituents, still greater quantities of heat were evolved by the energetic union of the separated constituents. Had the silica not been present as free quartz it would have required a larger percentage of coke, even with a much higher sulphur content, as I have learned by hard experience.

The Partridge blast-heating system extracts 90% of the latent heat of the molten slag and puts it back into the furnace. This item represents on an average about 20% of the total heat distribution, and is a vital loss in the standard furnace practicing pyritic smelting, or even partial pyritic smelting. Naturally I did not blow in with 5% coke and did not cut down to this amount until the blast was hot. The furnace was then discharging 10 lb. per min. of slag having a formation temperature of 1180° C. or 2156° F.; a decided difference from Professor Jarvis' figure of 1500° F. Assuming that 90% of the heat is extracted, there would then be 5239 B.t.u. put back into the furnace, which added to the 10,630 B.t.u. developed by the combustion of sulphur and coke is 15,869 B.t.u., and is certainly "the necessary heat units to effect the chemical reactions in the furnace," and, with the heat of combination added, still leave a sufficient surplus for escaping gases, matte, jacket water and radiation.

Professor Jarvis questions the feasibility of the furnace, and yet immediately follows this remark by enumerating the very factors that make it feasible, with one exception, however, the metallurgist. While a five-ton plant running on medium-grade ore naturally could not afford a "high-priced" metallurgist, I fail to see why he assumes that no metallurgist at all is necessary, for the Partridge furnace operates under the same laws of chemistry and metallurgy as a standard one. But, above all, such a small furnace requires manipulation, as my critic will find if he ever attempts to operate one, and the plant is absolutely valueless without a trained man in charge of it.

In conclusion I will say that the "unprincipled visitor" referred to would have had to remain on the charging floor hour after hour, and every eight minutes heave in his quota with the little 5-lb. handful of coke that accompanied each charge. It is highly improbable that any of the natives in the "land of the hook-worm" would evince the energy that this amount of interest would require.

CLEMENT H. MACE.

Charlotte, N. C., June 12, 1913.

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The "Practical" Mining Man and the Mining Geologist

The recent article in the JOURNAL of May 10, 1913, by George E. Collins is both interesting and valuable but it is possible that erroneous conclusions may be drawn from it. Years of experience with the so called "practical" mining man has shown that if he is properly approached and treated like an intelligent fellow man, the observations he has made and the evidence he has obtained upon the deposit he is working are of the most valuable kind. He should be encouraged to talk freely and to give his conclusions and judgment, which ought always be sought by the mining (economic) geologist.

No one can know the individual deposit he has been working upon better than does the more intelligent of these "practical" mining men. Their failures occur when they are taken to new localities and placed upon deposits of a different nature. Here they attempt to make everything conform to their past experience, and their errors then become more fatal and glaring than those of the trained and practical (as he should always be) mining geologist. The former has not the necessary knowledge nor skill that will enable him to recognize the different conditions and draw correct conclusions.

The dangerous mistake is the common and erroneous belief that because a practical but uneducated mining man is excellent in one locality, he is a good mining geologist for a different deposit, and will prove a safe guide.

In speaking of education it should be noted that there are two classes of educated mining men, one educated in schools and the other educated by his own unaided studies. Both of these are to be distinguished from the uneducated practical miner, and both of the educated classes may be far more practical than the uneducated one. Of the two educated classes, the self-educated man deserves much more credit than the school-educated one, for he has had to struggle unassisted against much greater difficulties and obstacles than has the latter and hence the perseverance, energy, and labor required have been the greater.

M. E. WADSWORTH.

University of Pittsburgh, June 2, 1913.

EDITORIALS

Pending Metallurgical Problems

Metallurgical progress during the last 10 years has been phenomenal. We have witnessed the development of the blast-roasting process, the methods of sintering fine ore, the introduction of the basic copper converter, the flotation process of concentration. These and others have contributed largely to economy in the production of the metals. In some processes the cost of smelting has been brought down to a very low figure. In some cases it seems as if there be no room for further improvement. But let no budding inventor turn aside from the metallurgical field with the idea that there are no more problems to solve, no more untreated ores to conquer. Opportunity has not yet locked her doors.

Let us mention some of the pending problems—some of the things that remain to be done. Most of these are at present engaging the attention of inventors. We shall no doubt within a few years witness a solution of several of them.

There is a vast quantity of low-grade copper ore, both oxidized and sulphide, whereof the copper cannot be profitably extracted by any existing method. The millions of tons of tailings that are being sluiced away from our porphyry mills worry their managers.

The economical treatment of this class of material is one of our pressing problems. A solution is sought in hydrometallurgical methods. The Anaconda company has already advanced so far in this direction that an experimental plant of 80 tons daily capacity is now being erected to test the Laist process. The Guggenheim engineers seem to have supreme confidence in their ability to treat the Chuquicamata ore by lixiviation and electrolytic precipitation. Others of the big copper companies are conducting similar experiments.

Another metallurgical problem of the first order is the capturing of the sulphur of sulphide ores in a rough and ready way. It can be done, of course, by making sulphuric acid out of it, but sulphuric acid is not feasibly made in many remote places. In the meanwhile many smelters are harassed by smoke complaints. If the sulphur of their ore could be separated in its elemental form, which would enable it to stand long-distance transportation to market or at the worst to be piled up out of harm's way a great progress would have been made. It seems likely that something of that sort will soon be accomplished either by the Thiogen process or the Hall process, or both.

A problem that is staring us in the face but is less near to solution is the economical treatment of the low-grade calamines, such as those of Leadville, Colo. New supplies of zinc ore are needed and our smelters are now willing to take ore of low grade that 10 years ago they would not have considered for a moment, but there is a limit below which they cannot pass and a large quantity of ore is consequently valueless for the time being.

The problem of the mixed sulphide ores is now solved in the main, thanks to the flotation process, which has distinctly beaten magnetic separation, electrostatic separation and the others devised for this purpose. Flotation seems to be able to deal with a more finely crushed ore than any of the other processes, which, of course, promotes cleanness of the minerals separation. But what are the smelters going to do with the increasing tonnage of very fine material? Or rather what improved means are they going to devise to handle it economically? Blende of 200-mesh size is roasted with much more difficulty than blende of 8-mesh. The zinc smelters will shortly be needing a better method of roasting, even if they are not already so in need.

We have not had it in mind to summarize all of the metallurgical problems of the day, but only to mention a few of them. It may be safely accepted that metallurgy is by no means an exhausted art. It still offers many inviting subjects for study and experimentation.

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Steel Production in 1912

The steel production of the United States in 1912 far exceeded all previous records, having reached the great total of 31,251,303 long tons, which was an increase of 32% over the previous year, and of 5,156,384 tons over 1910, the year of highest production previously. The make of steel in this country exceeded that of Germany, Great Britain and France combined. One remarkable point about the production in 1912 was that the total exceeded that of pig iron by 1,524,166 tons. As there were no large stocks of pig iron on hand at the beginning of the year—as had been the case two years previously—this excess was due wholly to the use of a large proportion of scrap in the openhearth furnaces.

Another notable point is the continued rapid growth of the openhearth process. Last year two-thirds of our steel was made in the openhearth furnace, and the quantity was more than double that of bessemer or converter steel. From the tables given on another page it will be seen that in 10 years the proportion of openhearth steel to the total make has grown from 40.1 to 66.5%, while that of bessemer has been diminished from 59.1 to 33%; the proportion of crucible and special steels remaining very nearly constant. Openhearth steel is now in the strongest demand for rails, structural material and other important forms of finished material; and the converter is gradually falling back into the position of an auxiliary.

The special steels show little change. Steel made in the electric furnace seems to be losing rather than gaining.

It is of interest to compare the methods and quantities of the two great steel producers of the world:

	United States		Germany	
	Acid	Basic	Acid	Basic
Converter	10,327,901	.....	287,511	10,015,631
Openhearth	1,139,221	19,641,502	194,924	6,650,565
Crucible	121,517	.....	79,190	.....
Electric, etc.	21,162	.....	74,177	.....
Totals	11,609,801	19,641,502	535,802	16,666,196
Total all kinds	.....	31,251,303	.....	17,301,998
Proportion of steel to pig iron	.....	105.1	.....	96.8

The differences in practice are largely determined by the nature of the ores, which form the basis of the industry. The basic or Thomas-Gilchrist converter, which make two-thirds of the German steel, is not used at all in this country, where the openhearth furnace is the maker of basic steel.

The Panama-Pacific Exposition

Elsewhere in this issue we publish a communication from Charles E. van Barneveld, chief of the Department of Mines and Metallurgy of the Panama-Pacific Exposition, which is the first official calling of the attention of mining men to this important event and their own expected participation in it. We are going to be quite frank in saying that the mining exhibits at Chicago and St. Louis were rather useless efforts and devoid of any great interest. An exhibition of this kind is apt to be dreary and becomes excessively tiresome when it resolves itself into an endless array of specimens of ore. The relief that is afforded by the presentation of some districts in an illuminating way shows, however, that even this part of a mining exhibition may be made worth while. As for the exhibition of machines, methods of mining and milling, metallurgical processes, etc., the opportunity is boundless.

At San Francisco there will be a better atmosphere than at either Chicago or St. Louis. San Francisco owes itself largely to the mines of California and Nevada, and it is still an important headquarters of mining men. The memories of the old days celebrated by Bret Harte and Mark Twain, the monuments that have been left by the Comstock millionaires, and the active interests of the present generation of mining men ought to inspire a representation of mining and metallurgy in the forthcoming exposition that will be original, valuable and interesting. Toward this end we urge the coöperation of mining operators in all parts of the world and especially in all parts of North America, for while this exposition is to be conducted under the direct auspices of California its scope is international. The international engineering congress, which is to be held in San Francisco in 1915, will draw professional men from all parts of the world.

Ore and Coke Rates

The Interstate Commerce Commission this week gave out its decision on two cases of considerable importance to the blast furnaces of the Central West. The first of these affects the rates on Connellsville coke to points in Ohio and Pennsylvania, ordering a general reduction and equalization of those rates, on the ground that they have been excessive and in some cases discriminating. The reductions vary from 5 to 15%, and affect the most active iron-making districts in the Central West, including the Mahoning Valley, the Cleveland district in Ohio and the eastern part of Pennsylvania. To all of the many furnaces and steel works in those districts there will be an important reduction in the cost of fuel. One active district, however, the Shenango Valley, in Pennsylvania, is not affected, as the carriage of coke from the Connellsville region to that district is strictly intrastate business, and so beyond the jurisdiction of the commission.

The second decision is on complaints against the existing rates on Lake Superior ore from Lake Erie ports to the Pittsburgh and Wheeling districts. The existing rates from Lake Erie to the Wheeling district are 60c. per ton, while the rate to Pittsburgh is 96c. The Commission does not prescribe any rate, but it orders that the Pittsburgh rate must not be higher than the Wheeling rate, the distances and conditions being practically equal. The railroads may increase the Wheeling rate, but the Pittsburgh rate must not exceed whatever figure may be fixed for that rate.

In the ore-rate decision the Interstate Commission lays down a principle of some importance. The railroads defended the rates on the ground that they were differentiated in order to equalize the assembling costs—that is the costs of raw material for iron and steel making in the two districts. But the Interstate Commission holds that the railroads have no right to consider such equalization. They can take into account only distances and traffic conditions and have no right to deprive a town or a district of any advantages of location or distances from supplies which it may hold by differentiating rates. In the iron trade this will apply in a good many cases where the railroads have undertaken to balance local conditions by rate charges.

Treadwell in 1912

The three companies operating on the gold deposit of Douglas Island, across from Juneau, Alaska, are, in effect, one mine. The remarkably favorable conditions obtaining for this deposit and the splendid management which has rendered it so well and favorably known are fittingly coupled with a custom of issuing annual reports which leave little to be desired in any point. Their annual publication is always a matter of interest in mining circles.

The reports for 1912 which we abstract elsewhere in this issue show the usual and expected excellent performance for the year. The mills handled 1,576,130 tons of ore and produced $4,080,301. Of this, $2,025,703, a little less than half, was profit. Dividends of $1,199,360 were paid during the year, and $944,351 was charged to depreciation on property and plant. This last sum, almost half of the profits, is apparently a reserve fund or surplus. Its ultimate object is not stated in the report. Development work to the extent of 21,573 ft. accompanied the mining during the year, and while the reserves were slightly decreased, by about 534,000 tons, they still remain at nearly 11,000,000 tons, worth between $2.70 and $2.75 per ton. If, as in 1912, half of these reserves will be profit, they represent a return between $13,000,000 and $14,000,000, which ought to be a source of satisfaction to the stockholders of the various companies. Viewed in the light of general reliability, past performance and future promise, few American mines can surpass the Treadwell group.

Mining in the Philippines seems to be more attractive to Australian than to American capital. Already several Australian companies are operating there, chiefly on gold-dredging ventures, and a company with $1,000,000 capital has been successfully floated at Melbourne to work dredges on a large scale.

BY THE WAY

An engineer states that in looking over a report on a Costa Rican mine he found the following: "The lode is composed of a kind of black lava containing a quantity of grease, and very rich in gold. In order to extract the grease the ore must be burnt and this is easily done in the mine. When burnt it can be washed and the gold taken out with little labor." The "black lava" proved to be decomposed quartz heavily stained with oxide of manganese, and the "grease" was small deposits of pure manganese oxide.

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Contracts for steel products are taken for two months, four months, and in the case of structural material, sometimes over two years. The prices obtained by the U. S. Steel Corporation are governed over the long contracts by the condition of the market at the time the contract is taken and the outlook. The Steel Corporation's price on steel bars has been $1.40 per 100 lb. f.o.b. Pittsburgh mill since last August, although a number of its competitors have been selling bars as high as $1.60, this being premium for quick delivery.

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Duplicating frequent phenomena in industrial lines, the byproduct seems about to have its day in Cobalt. We note in the annual report of the Temiskaming company that $935 was received for 13,219 lb. of copper. The Nipissing also obtained $647 for cobalt in products sold during 1912. The Nipissing, furthermore, has closed a contract for disposing of its residues; the terms of which specify a fair price for included cobalt. If the Cobalt mines are to be paid hereafter for the contents other than silver in their ores, a tidy sum will be added to the total production of that district.

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In the latest report of the chief mine inspector of Ontario, note is made of the death of one "Dymater Petryno, a Polander," and also of "Matt Szwonkowski, a Polander." When a publication adopts a system of terminology it should at least be consistent. Thus by analogy, Leonardo Porco, described as an Italian, should be called a "Dago," Ludwig Raezkiewicz, a German, should be called a "Dutchman" and Joseph Rochefort, a French Canadian, should be called a "Canuck." We venture to call the attention of the Ontario Bureau of Mines to the fact that a native of Poland is a Pole.

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Great changes among the miners have taken place on the Rand during the last five or six years, according to the *South African Mining Journal* of Mar. 8. The lot of the miner underground has been greatly improved, particularly along the lines of ventilation and prevention of phthisis. Today the Rand miner is the most fortunate of his kind in the world; he obtains high wages and is so situated that surface living conditions could hardly be improved. But in spite of his congenial lot it can scarcely be alleged that the Rand miner is the best in the world. Among many first-class men there are many more who are rather to be congratulated on their adaptability to underground work than on any inherent knowledge of mining. This is due largely to the fact that a large proportion of the underground workers have been taken on from other lines of employment, and that few have been born and bred to the business. Although some of these make good workmen, the lack of the hereditary mining instinct, together with the natural carelessness of the colored laborers, is largely responsible for the high accident and death rates. A contributing cause, however, is the high pressure at which work is now conducted, speeds and tonnages having increased with depth and consolidation. Unfortunately, this high pressure has not as yet resulted in economy. The tendency has rather been for working costs to soar. The transition stage has not yet been passed, however, and it may confidently be expected that when once the expensive improvements have been paid for and their beneficial effect on operations is felt, an era of low-cost mining will ensue.

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The following article, from a daily paper, will strike a sympathetic chord in the breast of many metal-mining superintendents, even if it does especially treat of conditions in an eastern coal-mining region: "Numerous attempts to compile a list of mine-workers' holidays in the anthracite-coal region of Pennsylvania have so far been a failure. In view of the many recent 'Button' and other strikes, these frequent holidays are becoming an increasing source of loss and annoyance to the operators. Capt. W. A. May, president of the Pennsylvania Coal Co., said recently that he could never tell when a miners' holiday was coming or how many men it would involve. His company has 29 nationalities on its payrolls, and each has holidays peculiarly its own. There are American, English, Welsh, Scotch, Irish, German, Slavonian, Italian, Polish, Hungarian, Austrian, Swedish, Russian, Belgian, Bohemian, French, Finnish, Canadian, Lithuanian, Greek, Tyrolean, Danish, Syrian, Montenegrin and Horwat mine workers in the anthracite region. The workers classified as 'American' include all those born in this country, even if their parents were foreign. Several of the groups, like the Slavonian, are capable of still further subdivision. Polish Catholics have nine holidays, Greek Catholics 19, French and French-Canadians from three to five, Jews of various nationalities from six to eight, Lithuanians four, Hungarians a couple more, Welsh, Irish and English miners have one or more holidays each, while Italians make holidays of various saints' days, the number varying according to the part of Italy from which they come. In addition to this, 'Mitchell Day' is largely celebrated throughout the region." This reminds us of mining in Mexico in those days of yore when "revolutions" were not and we used to mine. We had only one nationality, but it had holidays up to the number of 365, selected at will. The trouble used to be that we never knew which were going to be selected. We knew, of course, that no work was going to be done during Holy Week, nor on the *fiesta* of San Miguel, who was the patron saint of our region, nor on certain other days; but every now and then the men would fail to appear for work and inquiry would develop that it was the *fiesta* of Santa Rosa, or some other saint, whom nobody had thought of until conversation went around in the village the previous evening. The superintendent was never informed in advance and had to be content with the subsequent explanation!

Steel Production in the United States

The Bureau of Statistics of the American Iron & Steel Institute, William G. Gray, statistician, has received from the manufacturers statistics of the production of all kinds of steel ingots and castings in the United States in 1912. The production of ingots and castings by all processes reached the remarkable total of 31,251,303 gross tons, against 23,676,106 tons in 1911, an increase of 7,575,197 tons, or almost 32%. The remarkable point is that while the production of steel in 1911 exceeded that of pig iron by a small amount—26,559 tons—in 1912, the excess was no less than 1,524,166 tons. As there were no large stocks of pig iron on hand at the beginning of 1912, it is evident that the openhearth furnaces must have used a large proportion of scrap in making steel last year.

The total production of steel of all kinds in 1912 is given as follows:

	1911	1912			
	Total	Ingots	Castings	Total	Per ct.
Bessemer	7,947,854	10,259,151	68,750	10,327,901	33.0
Acid openhearth	912,718	712,371	426,850	1,139,221	3.6
Basic openhearth	14,685,932	19,197,504	443,998	19,641,502	62.9
Crucible	97,653	100,967	20,550	121,517	0.4
Electric	29,105	14,147	4,162	18,309	0.1
Miscellaneous	2,844	542	2,311	2,853	.....
Total	23,676,106	30,284,682	966,621	31,251,303	100.0

The total increase in 1912, as compared with 1911, was 7,575,197 tons, or 32%. The increase in basic openhearth steel in 1912 was 4,955,570 tons, or 33.7%; in acid openhearth, 226,503 tons, or 24.8%. The gain in bessemer steel was 2,380,047 tons, or 29.9%. The production of bessemer-steel ingots was practically all in standard converters; that of castings was from tropenas and other modified forms of converters. No basic converters are in use in the United States. The make of openhearth steel in 1912 was over twice that of converter.

Included in the 19,641,502 tons of basic openhearth-steel ingots and castings produced in 1912 are 1,438,654 tons of duplex steel ingots and castings which were made from metal partly purified in bessemer converters and finally purified in basic openhearth steel furnaces. This steel was produced by seven works, four being in Pennsylvania, one each in Maryland, Alabama and Illinois.

The production of crucible steel showed a gain of 24% over 1911; that of electric steel, however, was considerably less than in 1911 and 1910. The make of crucible steel was exceeded in two previous years.

Steel Production for Ten Years

The total make of steel of all kinds in the United States for 10 years past is given in the following table:

	Bessemer		Openhearth		Crucible, etc.		Total
	Tons	%	Tons	%	Tons	%	Tons
1903	8,592,829	59.1	5,829,511	40.1	112,238	0.8	14,534,978
1904	7,859,140	56.7	5,908,166	42.6	92,581	0.7	13,859,887
1905	10,941,375	54.6	8,971,376	44.3	111,196	1.1	20,023,542
1906	12,275,830	52.5	10,980,413	46.9	141,893	0.6	23,398,136
1907	11,667,549	49.9	11,549,736	49.5	145,309	0.6	23,362,594
1908	6,116,755	43.6	7,836,729	55.9	69,463	0.5	14,023,247
1909	9,330,783	38.9	14,493,936	60.5	130,302	0.6	23,955,021
1910	9,412,772	36.1	16,504,509	63.3	177,638	0.6	26,094,919
1911	7,947,854	33.5	15,598,650	65.9	129,602	0.6	23,676,106
1912	10,327,901	33.0	20,780,723	66.5	142,679	0.5	31,251,303

The growth of production in the 10 years has been almost wholly in openhearth steel. Bessemer or converter steel reached its maximum in 1906 and has declined since then, its proportion of the total falling from 59.1 to 33%. Openhearth steel ran bessemer closely in 1907; exceeded it in every year since that, and in 1912 its output was more than twice that of bessemer steel.

Alloy Steel

The following table gives the approximate production by processes of steel treated with ferrovanadium, ferrotitanium, ferrochrome, nickel and other alloys:

	Ingots	Castings	Total
Bessemer	159,427	18,814	178,241
Acid openhearth	85,188	75,590	160,778
Basic openhearth	408,007	5,095	413,102
Crucible	27,553	3,208	30,761
Electric, etc	9,217	402	9,619
Total	689,392	103,109	792,501

In 1912 there were 143 works which made some form of alloy steel. This alloy steel constituted 2.5% of the total make. A large part of this steel was used in the manufacture of rails.

Number of Steel Plants

At the close of 1912, there were 30 plants equipped to make steel by the standard bessemer process, 35 plants by the tropenas process, and 37 plants by other modifications of the standard bessemer process, while at the close of 1911, 29 plants were equipped to make steel by the standard bessemer process, 29 by the tropenas process, and 31 by other modifications of the standard bessemer process. There were no bessemer plants building at the close of 1912, but 13 plants were projected.

At the close of 1912, there were 182 complete openhearth-steel plants, of which 157 were active during the year and 25 were idle. Of the total 113 were equipped to make basic steel, of which 101 were active during the year and 12 were idle, and 96 were equipped to make acid steel, of which 77 were active and 19 were idle. Some of the plants were equipped to make both basic and acid steel. Six plants were being built on Dec. 31, 1912. On the same date work had been suspended upon three partly erected plants. In addition, five plants were projected. In 1912 four plants made steel by the cementation and other minor processes; in 1911 five plants were active. On Dec. 31, 1912, one plant for the manufacture of steel by a special process was being built in the State of Washington.

The total number of steel plants of all kinds in existence at the close of 1912 was 306, which includes one openhearth plant in the Panama Canal Zone. This total is an increase of 24 during the year.

Geological Survey Reports on Rochester

F. C. Schrader, of the U. S. Geological Survey, has just made an examination of the new district of Rochester in Humboldt County, Nevada. A strike in Nenzel Hill was made late in November, 1912, and the shipment of a couple of carloads of high-grade ore by Joe Nenzel, Frank Schick and Walt Moynaugh about Christmas started the Rochester boom. Leases on blocks 300x600 ft. in size were taken and were operated actively by experienced mining men, with the result that to date the development of the mines and the showing of ore are remarkable. Six or eight leases are opened to a depth of 130 ft. by crosscut tunnels from 100 to 300 ft. in length. About 2000 tons of ore averaging $30 per ton has been mined and shipped and it is said that 100,000 tons of ore are in sight. Nearly a score of properties are producing. The ores are chiefly silver-bearing but carry also gold, which in some of the ore amounts to 50% of the value. They were apparently deposited by hydro-

thermal solutions. Packard, the newest settlement, but a few weeks old, at the south base of Packard Hill, has a population of about 100 which is daily increasing. In Nenzel Hill the veins, 10 or more in number, vary from 100 to 3700 ft. in length and some apparently have a vertical range of at least 400 ft. The west vein or lode, now being worked chiefly on the Codd lease and the Platt lease, is about 32 ft. in width and contains two veins, 7 to 8 ft. wide, of good ore, composed chiefly of alternating layers of quartz and silicified rhyolite. The workings on these veins have been continuously in ore. Packard Hill, the seat of the new strike, is in the southern part of the district, at an elevation of about 5800 ft. in the lower part of a broad ridge, and on the trend of the Nenzel Hill zone of mineralization.

The ore deposits of the district are chiefly quartz replacement veins in fissures and shear zones in rhyolite and rhyolitic rocks which are of great thickness. The rocks vary from felsitic to coarsely porphyritic. They are more or less silicified, devitrified and sericitized and were referred by the geologists of the Fortieth Parallel Survey to the Triassic period. The rocks dip about 35° E., but the veins dip 60° W. and are approximately conformable with the dominant sheeting and shear structure of the country rock.

The Treatment of Partially Oxidized Copper Ore

A good many of the porphyry copper mines possess orebodies which in their upper portions are partially oxidized. In attempting to concentrate such ores by the ordinary method of washing on tables, buddles, etc, a good saving of the sulphide constituent can be made, but only a small portion of the oxilized copper is recovered. Bearing upon this subject, J. Parke Channing, consulting engineer of the New Keystone Copper Co., made some interesting remarks in his last annual report to that company, as follows:

Inasmuch as a considerable portion of this copper is in an oxidized form, it was not considered advisable to make any arrangements for treating it by the usual water-concentration methods, as the results at Miami showed that, while 80% of the chalcocite in the ore could be saved, only 30% of the oxidized material was obtained in the concentrate.

Taking into consideration the great strides which are now being made in flotation and leaching processes, we came to the conclusion that it was desirable for us to make experiments along this line, and for that purpose, early in the present year, R. C. Canby, a mining engineer of great experience in leaching and flotation, was engaged by this company and has been conducting a series of tests, and is now supervising some work at Miami along these lines.

Mr. Canby is in close touch with others in experimenting along the same lines, and arrangements have been made with several of them for the exchange of experiments, so that the same line of work may not be duplicated. It is still too early to make any definite report as to the result of Mr. Canby's investigations, but I may say that it is not unlikely that the problem will be solved during the present calendar year. It must be understood that in work of this kind the mere chemical side of it is of minor importance, the more important part being the mechanical side, i.e., the proper and continuous economic handling of the ore without undue labor costs or undue wear upon the apparatus, either by chemical action or mechanical attrition. It is along this line that particular attention is being given. In the final precipitation of the copper from the solution, several methods are open and experiments on these lines are being carried on by others and will be checked by us. This work seems so promising and so near a solution that it certainly would be very short-sighted for the New Keystone Copper Co. to make any arrangement to treat its ore by the present water-concentration method.

The Metal Tariffs in the Senate

WASHINGTON CORRESPONDENCE

The Senate Finance Committee has made some changes in the new tariff bill, which have been submitted to the Senate but not finally discussed or settled. The changes in the metal schedules are as follows:

Aluminum ingots, scrap, etc., are changed from 25% to 2c. per lb.; sheets, plates and other manufactures, from 25% to 3.5c. per lb. Barium, calcium, magnesium, sodium, potassium and alloys of those metals, 25% *ad valorem*.

Antimony as regulus or metal, 10%; duty to be based on metal content of ores, etc., with provisions for smelting in bond. Antimony oxide and other salts, 25% *ad valorem*.

There have been added to the free list in the iron and steel schedules the following:

Steel ingots, cogged ingots, blooms and slabs, die blocks or blanks, and billets, if made by the bessemer, Siemens-Martin, openhearth or similar processes, not containing alloy, such as nickel, cobalt, vanadium, chromium, tungsten, or wolfram, molybdenum, titanium, iridium, uranium, tantalum, boron and similar alloys.

Iron ore, including manganiferous iron ore, and the dross or residuum from burnt pyrites; iron in pigs, iron kentledge, spiegeleisen, wrought iron and scrap and scrap steel; ferromanganese; iron in slabs, blooms, loops or other forms less finished than iron bars, and more advanced than pig iron, except castings.

The administrative features of the bill have not yet been reported so that it cannot yet be positively stated in official form what innovations have been introduced into the provisions relating to bonded warehouses.

The Consolidated Copper Mines Company

The opposition of some of the Giroux stockholders to going into the proposed consolidation, has been abandoned, they having come to the conclusion that such a consolidation will be the only means of realizing on their investment.

At the end of 1911 the Giroux management estimated that it had about 17,000,000 tons of ore developed, but Henry Krumb, who recently examined the property in connection with the proposed consolidation, estimated only 7,000,000 tons.

The first step of the new company doubtless will be to attempt to increase its ore reserves. Experiments in concentrating the ore by flotation will probably be inaugurated in the old mill.

Rare Metals in Coal Ash

The occurrence of vanadium in the ash of coal and other carbonaceous deposits in Peru has been known for some time. A. Jorissen now announces (*Bull.* de la Soc. Chim. Belge, No. 21, 1913) that molybdenum is found in the cinders of certain Belgian coals, and that it exists in water-soluble form. The moral seems to be that ashes from coal from diversely mineralized districts should be examined for rare and precious metals.

Mining Companies—United States

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt
Acacia, g.	Colo.	1,438,989	$ 1	$ 129,618	Jan. '11	$0.01
Adams, s.l.c.	Colo.	80,000	10	778,000	Dec. '09	0.04
Ahmeek, c.	Mich.	50,000	25	1,700,000	Apr. '13	7.00
Alaska Mexican, g.	Alas.	180,000	5	3,187,381	May '13	0.30
Alaska Treadwell, g.	Alas.	200,000	25	13,185,000	May '13	1.00
Alaska United, g.	Alas.	180,200	5	1,397,050	May '13	0.60
Am. Zinc, Lead & Sm.	U. S.	165,360	25	985,820	Apr. '13	0.50
Anaconda, c.	Mont.	4,332,500	25	74,919,375	Apr. '13	0.75
Argonaut, g.	Cal.	200,000	5	1,200,000	June '10	0.05
Arizona Copper, pf.	Ariz.	1,426,120	1.20	1,831,011	May '13	...
Arizona Copper, com.	Ariz.	1,519,896	1.20	15,429,473	Feb. '13	0.48
Bagdad-Chase, g., pf.	Cal.	84,819	5	202,394	Jan. '09	0.10
Baltic, c.	Mich.	100,000	25	7,750,000	Dec. '12	7.00
Bingham N. H., c.	Utah.	228,690	5	294,219	July '12	0.10
Bonanza Dev., g.	Colo.	300,000	1	1,425,000	Oct. '11	0.20
Bunker Hill Con., g.	Cal.	200,000	1	741,000	June '13	0.05
Bunker Hill & Sul., l.s.	Ida.	327,000	10	14,301,150	June '13	0.20
Butte-Alex Scott, c.	Mont.	74,000	10	74,000	Nov. '12	0.50
Butte & Ballaklava, c.	Mont.	250,000	10	125,000	Aug. '10	0.50
Caledonia, l.s.c.	Ida.	1,300,000	1	52,000	June '10	0.01
Calumet & Arizona, c.	Ariz.	596,353	10	16,969,000	Mar. '13	1.25
Calumet & Hecla, c.	Mich.	100,000	25	121,050,000	Mar. '13	10.00
Camp Bird, g.s.	Colo.	1,100,051	5	9,383,512	Jan. '13	0.24
Centen'l-Eur., l.s.g.c.	Utah.	100,000	5	3,750,000	Mar. '13	1.50
Center Creek, l.s.	Mo.	100,000	10	420,000	Jan. '13	0.05
Champion, c.	Mich.	100,000	25	7,900,000	May '13	1.00
Cliff, g.	Utah.	300,000	1	120,000	Jan. '13	0.10
Cliff, g.	Alas.	100,000	1	180,000	Nov. '12	0.05
Colo. Gold Dredging	Colo.	100,000	10	200,000	Nov. '12	0.25
Colorado, l.s.g.	Utah.	1,000,000	0.20	2,570,000	Dec. '12	0.03
Columbus Con., g.s.	Utah.	285,540	5	226,832	Oct. '07	0.20
Commercial Gold	Ore.	1,750,000	1	43,750	Dec. '10	0.00½
Con. Mercur., g.	Utah.	1,000,000	1	3,415,313	July '12	0.03
Continental, s. l.	Mo.	22,000	25	286,000	Jan. '13	0.50
Copper Range Con., c.	Mich.	393,445	100	13,492,906	Apr. '13	0.75
Daly Judge, s.l.	Utah.	300,000	1	540,000	Mar. '13	0.15
Daly West, s.l.	Utah.	180,000	20	6,606,000	Jan. '13	0.15
Doctor Jackpot, g.	Colo.	3,000,000	0.10	45,000	Mar. '11	0.00½
Doe Run, l.	Mo.	65,782	100	3,237,869	Dec. '12	1.50
Elkton Con., g.	Colo.	2,500,000	1	3,029,460	May '13	0.02
El Paso, g.	Colo.	490,000	5	1,658,545	Mar. '13	0.12½
Ernestine, g. s.	N. M.	300,000	5	400,000	Dec. '12	0.00½
Fed. M. & S., com.	Idaho.	60,000	100	2,708,750	Jan. '09	1.50
Fed. M. & S., pf.	Idaho.	120,000	100	8,848,268	Mar. '13	1.50
Florence, g.	Nev.	1,050,000	1	840,000	Apr. '11	0.10
Frances-Mohawk, g.	Nev.	912,000	1	546,000	Jan. '08	0.05
Free Coinage, g.	Colo.	10,000	100	180,000	Dec. '09	1.00
Fremont Con., g.	Calif.	200,000	2.50	194,000	June '13	0.02
Frontier, s.	Wis.	1,250	100	161,272	June '13	2.00
Gemini-Key'ne, l.g.s.	Utah.	5,000	100	2,110,000	May '13	10.00
Gold Chain, g.	Utah.	1,000,000	1	130,000	May '13	0.03
Gold Coin of Victor	Colo.	1,000,000	1	1,350,000	Feb. '09	0.02
Gold Dollar Con.	Colo.	2,500,000	0.10	100,000	Dec. '12	0.00½
Gold King Con., g.	Colo.	5,750,370	1	1,407,319	Dec. '11	0.03
Golden Cycle, g.	Colo.	1,500,000	5	2,441,000	June '13	0.02
Golden Star, g.	Ariz.	400,000	5	140,000	Mar. '10	0.05
Goldfield Con., g.	Nev.	3,558,367	10	24,906,811	Apr. '13	0.30
Grand Central, g.	Utah.	500,000	1	1,520,750	Apr. '13	0.05
Granite, g.	Colo.	1,650,000	1	269,500	Nov. '12	0.01
Hazel, g.	Cal.	900,000	1	873,000	Nov. '12	0.01
Hecla, l.s.	Idaho.	1,000,000	0.25	2,800,000	May '13	0.02
Hercules, l.s.	Idaho.	1,000,000	1	3,650,000	July '11	0.06
Homestake, g.	S. D.	218,400	100	33,041,282	June '13	0.65
Horn Silver, l.s.s.	Utah.	400,000	25	5,662,000	Sept. '07	0.05
Iowa, g.s.l.	Colo.	1,666,667	1	200,166	June '11	0.00½
Iowa-Tiger Leasing g.s.	Colo.	12,655	1	13,921	Jan. '12	0.10
Iron Blossom, s.l.g.	Utah.	1,000,000	0.10	1,570,000	Apr. '13	0.10
Iron Silver, s.l.g.	Colo.	500,000	20	4,700,000	Apr. '13	0.10
Jamison, g.	Cal.	390,000	10	378,300	Jan. '11	0.02
Jerry Johnson, g.	Colo.	2,500,000	0.10	150,000	Aug. '11	0.01
Kendall, g.	Mont.	500,000	5	1,475,000	Nov. '12	0.02
Kennedy, g.	Cal.	100,000	100	1,831,001	Apr. '10	0.03
King of Arizona, g.	Ariz.	200,000	1	396,000	Aug. '09	0.12
Klar Piquette, s.l.	Wis.	20,000	1	162,500	Dec. '12	0.50
Knob Hill, g.	Wash.	1,000,000	1	45,000	May '12	0.00½
Liberty Bell, g.	Colo.	130,551	5	522,093	Oct. '10	1.00
Little Bell, l.s.	Utah.	300,000	1	75,000	Mar. '11	0.05
Little Florence, g.	Nev.	1,000,000	1	430,000	Jan. '08	0.03
Mammoth, g.s.c.	Utah.	400,000	25	2,280,000	Oct. '12	0.15
Mary McKinney, g.	Colo.	1,309,252	1	1,025,188	Apr. '13	0.02
May Day, g.s.l.	Utah.	800,000	0.25	148,000	Feb. '13	0.03
Mexican, g.s.	Nev.	201,600	2.50	20,160	Aug. '11	0.10
Miami, c.	Ariz.	664,993	5	1,844,516	May '13	0.50
Modoc, g.s.	Colo.	500,000	1	275,000	Dec. '11	0.01
Mohawk M. Co.	Mich.	100,000	25	2,975,000	Feb. '13	3.00
Monarch-Mad'a, g.s.l.	Colo.	1,000,000	1	40,000	May '11	0.01
Montana-Tonop., s.g.	Nev.	921,865	1	530,000	Dec. '12	0.10
Mountain, c.	Cal.	250,000	25	4,216,250	May '08	0.44
National, g.	Nev.	750,000	1	570,000	May '11	0.10
Nevada Con., c.	Nev.	1,999,394	5	11,488,196	Mar. '13	0.37½
New Century, s.l.	Mo.	330,000	1	237,600	Oct. '09	0.01
New Idria, q.	Cal.	100,000	5	1,700,000	Apr. '13	0.10
North Butte, c.	Mont.	410,000	15	10,865,000	Apr. '13	0.50
North Star, g.	Cal.	250,000	10	3,836,989	Mar. '13	0.20
Old Domin'n, M. & Sm.	Ariz.	162,000	25	2,956,000	Apr. '13	1.25
Ophir, s. g.	Nev.	201,600	3	2,068,360	Jan. '12	0.10
Opohongo, g.s.l.	Utah.	898,978	0.25	80,907	Jan. '13	0.02
Oroville Dredging	Cal.	700,000	5	1,383,036	Dec. '09	0.12½
Osceola, c.	Mich.	96,150	25	11,458,550	Apr. '13	3.00
Parrot, c.	Mont.	229,850	10	7,221,273	May '13	0.15
Pearl Con., g.	Wash.	1,909,711	0.05	181,422	Dec. '10	0.02
Pharmacist, g.	Colo.	1,500,000	1	87,500	Feb. '10	0.00½
Pioneer, g.	Alas.	5,000,000	1	4,041,526	Oct. '11	0.03
Pittsburgh-Idaho, l.	Ida.	803,000	1	216,810	Oct. '12	0.04
Pittsburgh Silver Peak, g.	Nev.	2,790,000	1	558,000	Mar. '13	0.02
Portland, g.	Colo.	3,000,000	1	9,277,080	Apr. '13	0.02
Quilp	Wash.	1,500,000	1	67,500	Feb. '13	0.01
Quincy, c.	Mich.	110,000	25	20,595,000	Mar. '13	1.50
Republic, g.	Wash.	1,000,000	1	85,000	Dec. '10	0.01½
Rochester, l.s.	Mo.	4,900	100	188,396	Dec. '10	0.50
Round Mountain, g.	Nev.	866,426	1	328,404	Sept. '10	0.04
Seven Troughs Coal g.	Nev.	1,500,000	1	37,500	July '12	0.02½

Mining Companies—United States—(*Continued*)

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt
St. Joseph, l.	Mo.	1,000,000	$10	$ 8,708,357	Mar. '13	$0.15
Shannon, c.	Ariz.	300,000	10	750,000	Jan. '13	0.50
Shattuck-Arizona, c.	Ariz.	350,000	10	1,225,000	Jan. '13	0.50
Silver King Coal. l.s.	Utah.	1,250,000	5	2,159,885	Apr. '13	0.15
Sioux Con., s.l.g.	Utah.	745,389	1	872,097	July '11	0.04
Skidoo, g.	Cal.	1,000,000	5	275,000	May '12	0.02½
Smuggler, l.s.s.	Colo.	1,000,000	1	2,235,000	Nov. '06	0.03
Snowstorm, c.g.	Ida.	1,500,000	1	1,147,118	Apr. '13	0.01½
South Eureka, g.	Calif.	299,981	1	366,881	Apr. '12	0.07
Standard Con., g.s.	Cal.	178,394	10	5,229,809	Jan. '12	0.10
Stratton's Ind., g.	Colo.	1,000,000	0.60	486,000	May '13	0.06
Success, z.	Ida.	1,500,000	1	925,000	May '13	0.02
Superior & Pitts., c.	Ariz.	1,499,793	10	4,229,418	Mar. '13	0.38
Tamarack, c.	Mich.	60,000	25	9,420,000	July '07	4.00
Tennessee, c.	Tenn.	200,000	25	3,406,520	Jan. '13	1.50
Tomboy, g. s.	Colo.	300,000	4.85	2,993,760	Dec. '12	0.24
Tom Reed, g.	Ariz.	909,555	1	1,264,367	May '13	0.06
Tonopah Belm't, s.g.	Nev.	1,500,000	1	4,343,003	Apr. '13	0.25
Tonopah Ext., g.s.	Nev.	943,433	1	353,786	Jan. '13	0.02½
Tonopah of Nev., s.g.	Nev.	1,000,000	1	10,450,000	Apr. '13	0.40
Tri-Mountain, c.	Mich.	100,000	25	1,250,000	Dec. '12	3.00
Tuolumne, c.	Mont.	800,000	1	520,000	May '13	0.10
Uncle Sam, g. s. l.	Utah.	500,000	1	495,000	Sept. '11	0.05
United Cop. Min., c.	Wash.	1,000,000	1	100,000	May '13	0.01
United (Crip. Ck.) g.	Colo.	4,000,100	1	440,435	Jan. '10	0.04
United Globe, c.	Ariz.	23,000	10	1,184,500	Apr. '13	7.50
United Verde, c.	Ariz.	300,000	10	33,122,000	May '13	0.75
Utah, s.l.	Utah.	100,000	10	325,000	Dec. '10	0.02
Utah, c.	Utah.	1,562,599	10	17,429,857	Mar. '13	0.75
Utah Con., c.	Utah.	300,000	5	7,650,000	Apr. '13	0.50
Valley View, g.	Colo.	1,000,000	1	240,000	Dec. '10	0.04
Victoria, g.s.l.	Utah.	250,000	1	207,500	Mar. '10	0.04
Vindicator Con., g.	Colo.	1,500,000	1	2,677,000	Apr. '13	0.03
Wasp No. 2, g.	S. D.	500,000	1	406,965	May '13	0.02
Wellington Mines, g.	Colo.	10,000,000	1	210,000	Jan. '13	0.001
Wolverine, c.	Mich.	60,000	25	7,940,000	Apr. '13	5.00
Work, g.	Colo.	1,500,000	1	172,500	July '08	0.00½
Yak, s.l.	Colo.	1,000,000	1	1,417,685	Oct. '10	0.04
Yankee Con., g.s.	Utah.	1,000,000	1	167,500	Jan. '13	0.01
Yellow Aster, g.	Cal.	100,000	10	1,131,789	Apr. '13	0.05
Yellow Pine, l.z.s.	Nev.	950,000	1	256,508	June '13	0.02
Yukon Gold, g.	Alas.	3,500,000	5	4,725,000	Mar. '13	0.07½

Coal, Iron, Industrial and Holding Companies

Amalgamated, c.	Mont.	1,538,879	$100	$76,659,791	May '13	$1.50
Am. Sm. & Ref., com.	U. S.	500,000	100	23,833,333	Mar. '13	1.00
Am. Sm. & Ref., pf.	U. S.	500,000	100	43,731,333	Mar. '13	1.75
Am. Smelters, pf. A	U. S.	170,000	100	7,620,000	Apr. '13	1.50
Am. Smelters, pf. B	U. S.	300,000	100	11,607,000	Apr. '13	1.25
Cambria Steel	Penn.	900,000	50	17,335,000	May '13	0.62½
Greene Cananea	U. S.	2,471,314	25	2,475,282	Mar. '13	0.25
Guggenheim, Expl.	U. S.	831,732	25	15,729,650	Apr. '13	0.62½
Inter'l Nickel, com.	U. S.	115,826	100	8,003,423	Mar. '13	2.50
Inter'l Nickel, pfd.	U. S.	89,126	100	4,006,814	May '13	1.50
Inter'l Sm & Ref.	U. S.	100,000	100	3,100,000	May '13	2.00
Lehigh Coal & Nav.	Penn.	482,956	50	22,535,092	Nov. '12	1.00
National Lead, com.	N. Y.	206,554	100	7,331,478	Mar. '13	0.75
National Lead, pf.	N. Y.	243,676	100	26,281,641	Mar. '13	1.75
Old Dominion, c.	Ariz.	293,245	25	3,946,918	Apr. '13	1.25
Phelps, Dodge & Co.	U. S.	450,000	100	24,059,304	Mar. '13	2.50
U. S. Steel Corp., com.	U. S.	5,083,025	100	181,696,289	Mar. '13	1.25
U. S. Steel Corp., pf.	U. S.	3,602,811	100	332,463,820	May '13	1.75
U. S. S., R. & M., com.	U.S.-Mex.	486,320	50	5,045,525	Apr. '13	0.75
U. S. Sm., R. & M., pf.	U.S.-Mex.	351,105	50	12,114,165	Apr. '13	0.87½

Canadian, Mexican and Central American Companies

Ajuchitlan, g.s.	Mex.	50,000	$ 5	$ 200,000	Oct. '12	$0.25
Amparo, g.s.	Mex.	2,000,000	1	1,086,884	May '13	0.04
B. C. Copper	B. C.	591,709	5	615,398	Jan. '13	0.15
Beaver Con., s.	Ont.	1,996,490	1	409,879	Dec. '12	0.03
Buffalo, s.	Ont.	1,000,000	1	1,877,000	May '13	0.03
Cobalt Townsite, s.	Ont.	1,000,000	1	330,000	May '13	0.03
Coniagas, s.	Ont.	800,000	5	4,640,000	May '13	0.45
Con. M. & S. Co. of Can.	B. C.	58,052	100	1,014,061	Oct. '12	4.00
Crown Reserve, s.	Ont.	1,768,814	1	5,041,121	May '13	0.05
Crow's Nest Pass C. Co.	B. C.	248,506	25	2,182,864	Mar. '11	0.25
Dominion Coal, com.	N. S.	150,000	100	5,550,000	Jan. '13	1.00
Dominion Coal, pf.	N. S.	50,000	100	4,915,000	Aug. '12	3.50
Dos Estrellas, g.s.	Mex.	300,000	0.50	13,755,000	Mar. '13	2.50
El Oro, g.s.	Mex.	1,147,500	4.85	8,668,418	Dec. '12	0.24
Esperanza, s.g.	Mex.	455,000	4.85	11,664,608	Jan. '13	0.36
Granby, s.l.c.	B. C.	148,496	100	4,419,832	Mar. '13	1.50
Greene Con., c.	Mex.	1,000,000	10	8,044,400	Feb. '13	0.45
Guanajuato D., pf., s.	Mex.	10,000	1000	274,356	Jan. '11	3.00
Hedley Gold	B. C.	120,000	10	924,000	Mar. '13	0.50
Hollinger, g.	Ont.	600,000	5	790,000	June '13	0.15
Kerr Lake s.	Ont.	600,000	5	4,470,000	Mar. '13	0.25
La Rose Con., s.	Ont.	1,498,407	5	3,888,491	Apr. '13	0.25
Le Roi No. 2, g.	B. C.	120,000	£1.30	1,471,580	Jan. '13	0.36
Lucky Tiger Com., g.	Mex.	715,337	10	1,789,797	May '13	0.05
McK.-Dar. Sav. s.	Ont.	2,247,692	1	3,438,396	Apr. '13	0.10
Mines Co. of Am. (new)	Mex.	1,700,000	10	*1,102,500	Apr. '13	0.12½
N. Y. & Hond. Ros.	C. A.	150,000	10	3,112,500	Dec. '12	0.20
Nipissing, s.	Ont.	1,200,000	5	9,990,000	Apr. '13	0.37½
Peñoles, s.l.g.	Mex.	80,000	25	6,210,688	Mar. '13	1.25
Peregrina M. & M., pf.	Mex.	10,000	100	328,656	Sept. '10	3.50
Pinguico, pf., s.	Mex.	20,000	100	600,000	Oct. '11	3.00
Right of Way Mnsts.	Ont.	1,685,500	1	202,260	Dec. '11	0.02
Rio Plata, s.	Mex.	373,437	5	345,714	Feb. '13	0.05
San Rafael, g.s.	Mex.	2,400	25	1,439,780	Oct. '12	0.90
San Toy, g.s.	Mex.	6,000,000	1	480,000	May '13	0.10
Sopresa, g.s.	Mex.	19,200	20	1,517,438	Jan. '11	34.00
Stand'd Silver-Lead	B. C.	2,000,000	1	725,000	May '13	0.02½
Timiskaming, s.	Ont.	2,500,000	1	1,534,155	Apr. '13	0.06
Tem. & Hud. Bay, s.	Ont.	7,761	1	1,777,269	May '13	3.00
Trethewey, s.	Ont.	1,000,000	1	961,998	Jan. '13	0.10
Wettlaufer-Lorrain, s.	Ont.	1,416,590	1	566,636	Jan. '13	0.05

*Previous to reorganization, $5,258,881.
†Previous to January, 1910, $324,644.

PERSONALS

H. V. Winchell has returned from Argentina.

Robert Hawxhurst, of London, is visiting New York.

J. Parke Channing recently visited the Cumpas district in Sonora, Mexico.

Frank H. Probert, of Los Angeles, is at Swansea, Ariz., on professional business.

H. S. Gieser is now in New York, having recently arrived from the Witwatersrand.

Kirby Thomas, of New York, is making some examinations in the Cobalt district, Ontario.

Per Geyer, professor of geology in the University of Stockholm, Sweden, is visiting California.

Ronald Harris, formerly of London, Ont., has taken charge of the Gold Bullion mine, near Knik, Alaska.

B. M. Snyder has left Los Angeles for an examination of properties in the Index district of Washington.

R. P. Wheelock has returned to Kingman, Ariz., from an extended business trip through the Middle West.

Capt. Alexander, of the Northern Partnership in the Atlin district in British Columbia, has returned from London.

Prof. S. B. Christy, who has been making an extended visit in New York and Boston, has returned to California.

J. C. Murray, for six years past editor of the "Canadian Mining Journal," at Toronto, Ont., has resigned that position.

H. B. Curtis, of New York, president of the McIntyre Gold Mines Co., is in Porcupine, Ont., on a visit of inspection to the mine.

Prof. Alfred C. Lane, of Tufts College, received the honorary degree of doctor of science at the recent commencement.

J. C. Wilson, deputy state mine inspector, of Arizona, has just returned to Chloride from an inspection of the old Vulture mine.

H. D. McCaskey, of the U. S. Geological Survey, was married to Miss Mary Louise Fuller, at Catasauqua, Penn., on June 7 last.

R. H. Flaherty, head of the mining department of the Canadian Northern Ry., has been making some examinations in Nova Scotia.

Ernest Harms, general superintendent of the Cia. Metalurgica de Torreon, Torreon, Mex., is in New York on business for the company.

S. E. Bretherton, of San Francisco, is in the East on business for the Afterthought Copper Co.; on his return he will go to Washington.

Frank S. Baillie is back at the Columbia mine near Sumpter, Ore., after a two weeks' trip to the coast. He has been manager of this mine for over 15 years.

H. W. Hardinge sailed from New York for Europe, June 14, on business connected with the Hardinge Conical Mill Co. He intends to visit England, Italy and Russia.

W. A. Cameron, superintendent of the properties owned by the Consolidated Mining & Smelting Co. in the Slocan district, B. C., will make New Denver, B. C., his headquarters.

C. H. Barton, consulting engineer of the Frisco Mines & Power Co., has very nearly recovered from a recent illness and is at present at Union Pass, near Kingman, Arizona.

Glenn Anderson has been appointed managing director of La Lucha Mine at Tlalpujahua, Michoacan, Mexico, and has started work on the erection of a mill and cyanide plant.

Hon. Louis Coderre, Canadian Minister of Mines, will, during August, make a tour through western Canada, including the Yukon, to familiarize himself with mining conditions.

Hallet R. Robbins has been appointed consulting engineer for the Chewelah Copper King Mining Co. He is assistant professor of metallurgy at the State College of Washington.

L. G. Huntley, of the Associated Geological Engineers, is at present engaged in a study of the Pelican Portage gas-field and other localities in central Alberta for the City of Edmonton.

John Vallance has retired from superintending the development of the Standard silver-lead mine, near Silverton, Slocan Lake, B. C., after eight years' work there. He has been succeeded by Ivan De Lashmutt.

Wakely A. Williams, superintendent of the smelting works of the Granby Consolidated Co., has been for some time at Granby Bay, B. C., where the company is building a plant to smelt ore from its Hidden Creek mines.

E. T. Corkill, chief inspector of mines for Ontario, has resigned his position to accept the appointment of safety engineer with the Canadian Copper Co., at Copper Cliff, Ont. He is succeeded by T. F. Sutherland, assistant inspector of mines.

Chas. S. Ackley, secretary of the McKiernan-Terry Drill Co., New York, has just returned from a three weeks' trip during which time he visited Chicago, St. Louis, Joplin, Kansas City and other cities in the Middle West. He reports business good.

J. J. O'Neill, of the Canadian Geological Survey, who accompanies the Stefansson Arctic Expedition, is commissioned to investigate the copper district in the southwestern part of Victoria Island, and will also make a study of the copper region on the mainland around the Copper Mine River.

Thomas C. Burke, of Baker, Ore., who has been nominated and confirmed as collector of customs at Portland by President Wilson, is a mining man of prominence. The mining town of Burke, near Baker, is named after him, as he has extensive interests there. Judge Burke, as he is known at home ,was born in Iowa, and went to Oregon in 1900, where he has lived ever since.

OBITUARY

M. L. Bates died at Golden, Colo., June 15, aged 76 years. He was born in North Carolina and went to Colorado in 1872. For some years he was with N. P. Hill at Black Hawk in the smelting business, but later moved to Golden.

David Briggs died June 1 at his home near the old mining town of Kerby, Josephine County, Ore. He was 58 years of age and was born in that mining camp. His father was George Briggs, who was prominently connected with the very earliest Oregon history, Fort Briggs, where the white settlers gathered to protect themselves from the depredations of the Rogue Indians, being on his claim. David like his father was connected with early mining operations of southern Oregon.

SOCIETIES

Oregon Agricultural College—The work of the department of Mining Engineering at this college will be reorganized before the opening of the next school year in September and the department will in the future be known as the School of Mines. Action authorizing this change has just been taken by the board of regents. These changes have been recommended and made in order that the young men preparing to enter the mining industry may receive the benefit of additional courses. Enlargement of the courses in mining is due to the revival of interest in the mining industry and the creation of an effective state bureau of mines and geology.

INDUSTRIAL NEWS

The Keystone Drill Co., Monadnock Blk., Chicago, Ill., has recently received contracts for its deep well pumping machinery from the following towns: Hildreth, Neb., Oneida, Wis., and Virgil, Ill.

The Hardinge Conical Mill Co., 50 Church St., New York, report a number of sales from its London office of Hardinge mills for shipment to Russia, Italy, and local use in England; also receipt of a second order for shipment of their mills to the Philippines.

The General Electric Co., Schenectady, N. Y., has received orders for equipment as follows: Old Dominion Copper Mining & Smelting Co., Globe, Ariz., two 815 kv.-a. alternating-current generators; two 100 kv.-a. synchronous motors; one 150-hp., six 75-hp., one 50-hp., one 20-hp. and three 10-hp. motors, and switchboard panels; Colorado Fuel & Iron Co., Denver, Colo., 200-kw. and 300-kw. rotary converters, a 50-hp. motor, three 110 kv.-a. and three 150-kv.-a. transformers.

and switchboard panels and accessories; Silver King Coalition Mines Co., Park City, Utah, 2.5-ton and three-ton electric locomotives and a 35-kw. motor-generator set; Goldfield Consolidated Mines Co., Goldfield, Nev., one 600-hp. induction motor; Aluminum Ore Co., Pittsburgh, Penn., 13 new motors ranging from 10 hp. to 25 hp. for its plant at East St. Louis, Ill.; Montreal Mining Co., Hurley, Wis., three four-ton mining locomotives.

NEW PATENTS

United States patent specifications may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

CENTRIFUGAL CONCENTRATOR. Paul Oscar Wells, Los Angeles, Calif. (U. S. No. 1,064,184; June 10, 1913.)

FLOTATION PROCESS—Apparatus for Ore Concentration. James Hebbard, Broken Hill, N. S. W., Australia, assignor to Minerals Separation, Ltd., London, England. (U. S. No. 1,064,209; June 10, 1913.)

SLIMES—Process for Magnetic Separation of Ores out of Slimes. Botho Schwerin, Frankfort-on-the-Main, Germany, assignor to Gesellschaft für Elektro-Osmose M. B. H., Frankfort-on-the-Main, Germany. (U. S. No. 1,063,893; June 3, 1913.)

ELECTRIC FURNACES—Refractory Container. Ezechiel Weintraub, Lynn, Mass., assignor to General Electric Co. (U. S. No. 1,063,483; June 3, 1913.)

FURNACE TILTING—Improved Tilting Arrangement for Metallurgical Furnaces. Jossingfjord Manufacturing Co., Jossingfjord, Norway. (Brit. No. 26,166 of 1912.)

ROASTING FURNACES—Improvements Relating to Calcining or Roasting Furnaces. M. Prager, Berlin, Germany. (Brit. No. 14,464 of 1912.)

WASTE HEAT—Process of Utilizing the Waste Gases of Combustion from Portland-Cement, Lime and Other Kilns. Friedrich Schott, Heidelberg, Germany. (U. S. No. 1,064,550; June 10, 1913.)

RECOVERING COPPER from Its Ores. Utley Wedge, Ardmore, Penn., assignor to The Furnace Patent Co., Philadelphia, Penn. (U. S. No. 1,063,629; June 3, 1913.)

CYANIDING — Precipitant for Recovering Metals from Solutions. Charles W. Merrill, Berkeley, Calif. (U. S. No. 1,063,570; June 3, 1913.)

GOLD FROM SAND—Apparatus for Separating Gold and other Metals from Sand, Etc. Ezra S. Hoyt, San Luis Obispo, Calif. (U. S. No. 1,064,223; June 10, 1913.)

PLACER-MINING MACHINE. Charles R. Dennison, Youngstown, Ohio, assignor of one-third to J. B. Chambers and one-third to W. V. Burnett, Youngstown, Ohio. (U. S. No. 1,064,296, and -297; June 10, 1913.)

ZINC-SHAVING MACHINE. Frederick W. Braun and Oscar C. Beach, Los Angeles, Calif., said Beach assignor to said Braun. (U. S. No. 1,064,284; June 10, 1913.)

FERRO-ALLOYS — Process of Producing Low-Carbon Ferro-Alloys. Isaac R. Edmands, Niagara Falls, N. Y., assignor to Electro Metallurgical Co., Chicago, Ill. (U. S. No. 1,063,341; June 3, 1913.)

DRILLS—Improvements in Chucks for Rock Drills. J. C. H. Vaught, Tonopah, Nev. (Brit. No. 24,120 of 1912.)

DRILLS—Improvements in or Relating to Rock Drills. G. H. Gilman, Claremont, N. H. (Brit. No. 19,508 of 1912.)

MINING SLUICE. Pierre Bouery, Weaverville, Calif. (U. S. No. 1,064,959; June 17, 1913.)

PLACER MINING—Miner's Gold-Pan. Edward O. C. Ord, Los Angeles, Calif. (U. S. No. 1,064,853, 864 and 865; June 17, 1913.)

BLAST FURNACES—Downcomer Construction for Blast Furnaces. Julian Kennedy, Pittsburgh, Penn. (U. S. No. 1,064,343; June 10, 1913.)

ELECTRIC FURNACE—Metallurgy of Zinc. Augustin Leon Jean Queneau, Philadelphia, Penn., assignor to Queneau Electric Zinc Furnace Co., Philadelphia, Penn. (U. S. No. 1,064,992; June 17, 1913.)

SODIUM NITRATE—Process of Extracting Sodium Nitrate from Raw Material. Mark R. Lamb, Milwaukee, Wis., assignor to Allis-Chalmers Co., Milwaukee, Wis. (U. S. No. 1,065,053; June 17, 1913.)

DRILL—Miner's Drill. Samuel T. Skeen, Sandoval, Ill. (U. S. No. 1,065,055; June 17, 1913.)

DRILL BIT SHARPENING MACHINES—Triple-Purpose Valve. John George Leyner, Denver, Colo., assignor to The J. Geo. Leyner Engineering Works Co., Littleton, Colo. (U. S. No. 1,065,062; June 17, 1913.)

DRILLS—Improvements in Deep-Boring Rock Drills. W. Harker, London, and A. T. Allcock, Spring Gardens, Newark-on-Trent, Eng. (Brit. No. 11,174 of 1912.)

LAMP—Miner's Lamp. Steve Koroly, Smithdale, Penn. (U. S. No. 1,065,147; June 17, 1913.)

MINE CAGES—Automatic Car-Stop and Gaging Apparatus for Mines. John E. Gable, Cambridge, and Ira A. Gable, Byesville, Ohio. (U. S. No. 1,064,067; June 10, 1913.)

MINE CARS—Latch for End-Gates of Mining Cars and the Like. Isaac K. Beaver, Wilburton, Penn., assignor of one-half to Elmer E. Straub, Wilburton, Penn. (U. S. No. 1,064,278; June 10, 1913.)

ROCK DRILLING—Flexible-Foot Supporting-Column for Rock-Drilling Engines. John George Leyner, Denver, Colo. (U. S. No. 1,065,060; June 17, 1913.)

CRUSHER. Ray C. Newhouse, Milwaukee, Wis., assignor to Allis-Chalmers Co., Milwaukee, Wis. (U. S. No. 1,065,332; June 17, 1913.)

ORE CONCENTRATION. Henry Howard Greenway, Melbourne, Vic., and Henry Lavers, Broken Hill, N. S. W., Australia, assignors to Minerals Separation, Ltd., London, England. (U. S. No. 1,064,723; June 17, 1913.)

CALCINING OR ROASTING—Improvements in or Applicable to Kilns or Furnaces Employed for Calcining or Roasting Ore, Limestone or Other Materials. A. L. Leigh, Scunthorpe, Eng. (Brit. No. 17,724 of 1912.)

ELECTRIC FUNACES—Improvements in Electric Electrode Furnaces. Jossingfjord Manufacturing Co., Jossingfjord, Norway. (Brit. No. 26,165 of 1912.)

ELECTROLYTES—Improvements in or Relating to Electrolytes for Use in Electro-Metallurgy. N. H. M. Dekker, Paris, France. (Brit. No. 17,836 of 1912.)

FEEDING DEVICE FOR FURNACES. Ernest B. Miller, Baltimore, Md. U. S. No. 1,064,516; June 10, 1913.)

LEAD ARSENIATE—Method of Making Lead Arseniate. Clarence B. Sprague, Salt Lake City, Utah, assignor to United States Smelting, Refining & Mining Co., Portland, Me. U. S. No. 1,064,023; June 10, 1913.)

TRADE CATALOGS

The Goulds Mfg. Co., Seneca Falls, N. Y. Catalog. Pumps. Illus.; 18 pp., 3½x5½ in.

Independent Powder Co., Joplin, Mo. Catalog. Dynamite. Illustrated, 62 pages, 5½x7½ in.

Myers-Whaley Co., Knoxville, Tenn. Catalog No. 3. Shoveling machines. Illus.; 26 pp., 8x10 in.

Joseph Dixon Crucible Co., Jersey City, N. J. Pamphlet. Graphite brushes. Illus.; 16 pp., 3½x6 in.

Spray Engineering Co., 201 Devonshire St., Boston, Mass. Bulletin No. 51. Air washers. Illus.; 8 pp., 6x9 in.

Standard Steel Works Co., Philadelphia, Penn. Catalog No. 12. Rolled steel wheels. Illus., 56 pp., 6x9 in.

The Watt Mining Car Wheel Co., Barnesville, Ohio. Catalog "F." Steel mine cars. Illustrated, 20 pp., 5½x8 in.

Power & Mining Machinery Co., Cudahy, Wis. Bulletin No. 43. Wet grinding tube mills. Illus.; 22 pp., 6x9 in.

Bausch & Lomb Optical Co., Rochester, N. Y. Catalog. Engineering instruments. Illustrated, 156 pages, 6½x9½ in.

Crocker-Wheeler Co., Ampere, N. J. Bulletin No. 152. Steam turbine driven generators. Illus.; 16 pp., 7½x10 in.

The Wickes Boiler Co., Saginaw, Mich. Series of folders. Wickes vertical water-tube safety steam boiler. Illustrated.

Chas. A. Schieren Co., 30-38 Ferry St., New York. Spanish catalog. Leather belting. Illustrated, 24 pages, 5½x8½ in.

Hoskins Mfg. Co., 453-471 Lawton Ave., Detroit, Mich. Bulletin No. 3. Thermo-electric pyrometers. Illus.; 48 pp., 6x9 in.

The Brown Hoisting Machinery Co., Cleveland, Ohio. Catalog L. Brownhoist locomotive cranes. Illustrated, 32 pages, 6x9 in.

Blake & Knowles Steam Pump Works, 115 Broadway, New York. Catalog No. 876. Single direct-acting pumps. Illus.; 84 pp., 6x9 in.

The Weber Chimney Co., McCormick Building, Chicago, Ill. Pamphlet. Reinforced-concrete chimneys. Illustrated, 48 pages, 5x9 in.

The Improved Equipment Co., 60 Wall St., New York. Bulletin No. 6. Silica retorts and settings for gas benches. Illustrated, 24 pages, 6x9 in.

Robins Conveying Belt Co., Park Row Building, New York. Bulletin No. 51. Coal and coke crushers, feeders and elevators. Illustrated, 6x9 in.

The Denver Fire Clay Co., Denver, Colo. Catalog. Case gasoline furnaces. Illus.; 16 pp., 6x9 in. Bulletin No. 115. Case oil muffle type furnaces. Illus.; 12 pp., 6x9 in.

Power & Mining Machinery Co., Cudahy, Wis. Bulletin No. 42. Crushing rolls. Illustrated, 32 pages, 6x9 in. Bulletin No. 44. Superior jaw crushers. Illustrated, 16 pages, 6x9 in. Bulletin No. 48. Sampling machinery. Illustrated, 44 pages, 6x9 in.

Chicago Pneumatic Tool Co., Fisher Building, Chicago, Ill. Bulletin No. 128. Miscellaneous equipment for pneumatic drills. Illus.; 12 pp., 6x9 in. Bulletin No. 132. Pneumatic motors and pneumatic geared hoists. Illus.; 20 pp., 6x9 in. Bulletin No. 133. Cylinder air hoists and jacks. Illus.; 12 pp., 6x9 in.

EDITORIAL CORRESPONDENCE

SAN FRANCISCO—June 19

Bald Rock Cañon, through which flows the middle fork of Feather River, in Butte County, is not impassable, and it has been prospected for gold by several prospectors. Newspaper stories have been printed recently picturing this cañon as impenetrable. The cañon has been explored by Western Pacific R.R. engineers and has been prospected as early as 1905, when fairly large quantities of placer gold were recovered. In 1908 a party of four men entered the cañon and found evidences of old workings, miners' tools and ladders. Good pay was found and some of the gravel yielded $4 per pan, but the difficulty of getting in and out and the isolation were discouraging. The cañon is three miles long and 4000 ft. deep and abounds in grand natural scenery of rugged rocks and waterfalls that would please tourists, but for prospectors and small companies of miners the association of rocks and waterfalls 4000 ft. below the mean level of the surrounding country, and the presence of large numbers of rattlesnakes and bobcats is not conducive to a prolonged stay even though the gravel be rich in gold. The cañon contains several small gravel bars, which could be profitably mined only by diverting the water of the river through a tunnel that could be driven for a length of two miles to Fall River. A similar tunnel was driven through the big bend on Feather River a length of 2¾ miles for mining purposes, but it is now a part of the system of the Great Western Power Co.

DENVER—June 21

The Christmas vs. Golden Cycle Suit is another of the now long list of suits in the Cripple Creek district to recover the value of ore mined by one company in the property of another. The Christmas Gold Mining Co. asserts that its claim was taken from it by an armed force sent by the Golden Cycle in July, 1904, and it evacuated the claim under protest. The Christmas company claims to have lost $500,000 in addition to ore of the value of $2,730,182 taken from the rich lode underground, and so has filed suit for these amounts in the U. S. district court.

The Coal Rate Case between the Consumers' League and the Colorado & Southern, Union Pacific and Burlington railroads is up again before Judge John A. Perry, of the third division of the district court. The first action was taken by the state railroad commission in 1909. That body reduced the rate for hauling coal from the northern coal fields as follows: Lump coal from 80c. per ton to 55c.; mine-run coal from 70c. to 50c. per ton, and slack coal from 60c. to 45c. per ton. The railroads appealed the case to the district court, and Judge Whitford, then sitting as district judge, sustained the Consumers' League at first hearing, but later reversing sustained the contention of the railroads. Should the league win in the present fight the railroad companies will have to refund more than $400,000 which has been collected from coal companies and consumers. They have ignored the rate fixed by the railroad commission and charged the rates as they originally fixed them. The chief point made by the plaintiff is that while the three defendant carriers in this case are charging more than 3c. per mile for this downgrade haul of 20 miles from the northern fields, the rate from the southern fields of the state is 1c. per ton mile, and up grade at that.

SALT LAKE CITY—June 19

The Report of the Surveyors in the second suit recently filed by the Silver King Consolidated against the Silver King Coalition for alleged trespass shows from a partial plat of the work made for the U. S. court, June 16, that the Coalition workings have been extended to within approximately 142 ft. of the Consolidated lines, and are headed toward Consolidated property. On account of caved stopes it was impossible to determine the full extent of the workings, as the survey could go no farther. The present condition of the caved stopes makes it impossible to tell how far they extend toward the property of the plaintiff and whether or not they are connected with other workings leading toward Consolidated ground. It was also impossible to reach the bottom of certain other workings, because they were filled with water. A map showing the position of the caved workings relative to the plaintiff's property was submitted to the court. An effort may be made to clean out some of the old workings to determine their extent, which the Coalition company says it is ready to do at the plaintiff's expense.

Silver King Coalition's petition for a writ of certiorari in the case of the Silver King Consolidated against the Silver King Coalition Mines Co. was denied by the supreme court at Washington, June 16. The suit was for an accounting for ore taken from ground owned jointly by the two companies. The original judgment decreed by Judge Marshall, of the U. S. district court, amounted to $735,045. Both the plaintiff and defendant companies brought the case to the circuit court of appeals, which sustained the plaintiff, and increased the judgment by $34,034. At present, the judgment with interest, including the increase ordered by the circuit court of appeals, amounts to $902,079. The accumulated interest has amounted to approximately $133,000. No further appeal remains for the Coalition company, and the judgment must be paid as soon as the decision of the supreme court has officially arrived. This is expected to reach Salt Lake City in about a month. The Silver King Consolidated may then take such steps as are necessary to collect. The judgment is secured by a $1,000,000 bond given at the time of the appeal two years ago. This bond is signed by eight men, and secured by Salt Lake property and real estate. The Silver King Coalition is understood to have the money on hand to pay the judgment, but will probably not pay until the last moment. When payment is made, a total of $903,000 will have been reached.

BUTTE—June 18

At the West Colusa Shaft, the Anaconda company has contracted with the Butte-Alex Scott company for the purchase of a portion of the latter's orebody, surrounding the shaft, which consists of a block measuring 75 ft. on the vein lengthwise of the shaft, 25 ft. on either side and extending from the 600- to the 2200-ft. level. It is estimated that the ore in this block is worth about $535,000. The first payment of $30,000 has already been made. The Anaconda company agrees in the contract to forever waive the right to bring suit upon any future apex question which may arise.

A New Legal Issue has been raised in a suit now being tried at Butte by Judge McClernan, of the district court, in which James A. Murray is endeavoring to establish his right to a portion of the Theseus lode claim in the northern part of the Butte district. In 1855, E. P. McKinstrey and Lee Mantle, of Butte, located the claim. The following year Mantle alone bore the expense of the representation work, and published notice declaring his partner out, and later patented the claim. Murray had in the meantime purchased an interest from McKinstrey, and his contention is that the notice was insufficient, as he should have been included as the holder of an interest. Mantle in defense sets forth the claim that he was not called upon to declare as to anyone except his partner. Judge McClernan has taken the matter under advisement.

HOUGHTON—June 21

Isle Royale's Second Dividend is a subject to which much attention is now being given. When the first dividend was announced, no statement was made as to whether it would be paid yearly, semiannually or quarterly. There was no assumption that it would be paid quarterly and there was little discussion of the subject at that time, for the shareholders, having waited 60 years for the first disbursement, were more intent upon personally receiving the checks and realizing that they would be paid at the banks than they were in wondering if ever there would be a second disbursement. However, the Isle Royale continues to earn substantial profits under the existing copper-market conditions. While the shipments have not been increased and the mine supplies only the one mill of three heads with rock the underground force is opening up the mine for the future. The company is operating 75 drills, and little stoping is being done, most of the work being drifting. All shafts, excepting No. 2, are being sunk, too, so that the elaborate plans for extending openings may be properly appreciated. The rock shipments from the Grand Portage lode are of a quality higher than the average of the mine. It may be stated, too, that in all the southerly openings on the Isle Royale main tract, particularly the new shafts, the general run of the lode is good.

Shipments at the Lake Mine continue to average about 330 tons per day. This rock is yielding 23 to 24 lb. of mineral per ton treated. The mineral contains a litle more than 60% refined copper and is smelted in the Quincy plant. In addition to the stamp-mill output a substantial amount of mass copper is being taken out at small cost and this goes direct to the smelter. This helps the output about 1 lb. per ton and the refined net output is now a little better than 16 lb. per ton. Underground conditions at the mine remain practically unchanged. In fact, if there has been any change at all it is a slight one for the better, although the management is extremely conservative in intimating any hope beyond that expressed in the recently issued annual report. The situation at the Lake plainly is this, the company is just about making expenses at present. With the limited rock shipments and the present price of copper it is not losing money, although it is running close to the margin all of the time. Doubling the rock shipments would put the Lake on a substantial paying basis. As far as underground physical conditions are concerned the rock output could be increased materially, if not doubled. There are enough openings in good copper-bearing ground to raise daily shipments by at least three carloads per day. The trouble has been to secure trammers. This is acknowledged plainly in the annual report. It might reasonably be expected that the Lake, under the circumstances, could afford to increase the pay of trammers to secure additional help, but the fact of the matter is that the compensation feature is not the real drawback. The Lake, the Winona and other mines that are located at isolated towns, remote from Houghton or Calumet or other good-sized cities have the greatest difficulty keeping these laborers on the job. They can always be depended upon to move to the towns after a short stay. They do not like the inactivity of the little mining location. It is too dull. The trammer problem is one that will require social-service efforts to solve. A motion-picture entertainment once a week might well be given by the mining companies at a profit in general results attained. It is interesting in a side light on this same social phase of the situation to note that the Calumet & Hecla is maintaining a successful baseball league this summer and the general manager personally offers the prizes for which these teams are competing; they are real prizes, too; a suit of clothes, costing $50, to each member of the winning team, 12 men in all, for first prize, to say nothing of special cash prizes for best batting, pitching and other averages, and second and third prizes for teams. The league is composed of employees. It is playing high-grade baseball this summer. Another such organization is the Calumet & Hecla band concerts, given two or three times a week, at the various mine locations. This musical organization, always fostered and helped by the mine, numbers 35 men; all high-grade musicians, and the band furnishes concert programs that are the equal of any in the country. But to get back to the situation at the Lake property. The lode is wide and it is freaky, always has been. Mining costs are, therefore, higher than the average for the copper country, but these will be reduced as the work proceeds and experience teaches the mining captains the difficulties they are to avoid, for the Lake lode differs in all mining characteristics from every other lode in the Lake Superior district. Those who are condemning the Lake mine as a commercial failure are premature in their expressions. It is a young property that has many problems to work out, but it has copper. It has many rich stretches of good ground. Some geological work has yet to be done to determine what may be expected in the future, and the present management must be credited for opening the ground well in advance of immediate requirements, the expenses of which development work have been charged against the cost of copper.

NEGAUNEE—June 19

The Crystal Falls District is preparing for a mild boom similar to that which has been in progress in the Iron River district. Pickands, Mather & Co. has begun work at the new Mastodon property taken over from the Longyear interests, and has asked for bids on stripping a portion of the big ore deposit. Contractors from various parts of the country have visited the site of the proposed pit. It is estimated that more than 1,500,000 cu.yd. of dirt will have to be moved. This is not so large an undertaking as the stripping on some of the Mesabi range pits, but is a big contract. Diamond-drilling continues. The Peninsula Power Co. of Iron Mountain, which is selling electrical power to mines in the Iron River district is considering an extension to the Mastodon section; the transmission line to Iron River passes only a few miles to the south. Extensive equipping and development work continue at the new Carpenter mine of M. A. Hanna & Co., southwest of Crystal Falls. A large shipment, probably 150,000 tons, will be forwarded from the stockpile of the Great Western mine of Corrigan, McKinney & Co., closed down for several years; this ore is notably high in sulphur.

DULUTH—June 21

Water is Higher in Lake Superior this season than in several years before, and that means increased freight movement for the season, more particularly in the iron ore and coal trades. One inch of additional draft at the Soo canals means for the average lake carrier 100 additional tons of freight. The Shenango Furnace Co. controls the Whiteside mine, on the Mesabi range, among other properties, and is constructing an ore-drying plant there. The work of putting in the foundations is now in progress. The plant will have a capacity of 300 tons per day. The Whiteside ore is rather high in moisture, from 14% to 18%, and it is proposed to reduce this to an average of about 5%. The processes will raise some of the ore which is not now commercial, up to grade. M. A. Hanna & Co. have a large ore-drying plant at the Brunt mine on the Mesabi range, which is operated successfully. From present prospects the ore-drying plants will become numerous on the Mesabi and also on the Cuyuna range.

Bessemer Ore on the Cuyuna, it is claimed, is found in largest quantity in what is known as the Peacock mine in village limits of Crosby, and one-fourth mile north of the settled part of the town. It is said that the lands adjoining the Peacock property are to be drilled at once. While no announcement has been made of the men interested in the new exploration, it is believed that they represent Eastern furnace interests. The Duluth-Brainerd Iron Co. is showing an excellent grade of manganiferous ore on the Cuyuna. The Mangan Steel, the Mesabi-Cuyuna and Cuyuna-Sultana are meeting with success in exploration on that range. A large body of iron ore, closely resembling that of the Zenith mine, at Ely, is being uncovered by stripping on the Vermilion range, by the Consolidated Vermilion & Extension Co. The overburden is 6 ft. deep. The results at several points, of finding ore close to surface, seems to warrant the belief that a large steamshovel proposition will be developed on the Extension ground of this company.

JOPLIN—June 21

Production of Zinc Is Being Curtailed. According to advices received here the Wisconsin zinc area is producing very lightly and only contract ore, while the same condition is reported from the West, with the only hope of improvement in the Western situation offered in the probable resumption of the Clark properties some time in September. The American Zinc, Lead & Smelting Co. has closed down the Davey mills Nos. 1, 2 and 4, and the Vogy mine, in the Porto Rico area. This company is closing its Webb City office and is practically out of the market here except for a few short-time contracts. The Granby Mining & Smelting Co. is buying lightly, yet the market is strong at quoted prices. The output here is about 6000 tons per week when it should be at this season of the year 6500 to 7000 tons per week.

JUNEAU, ALASKA—June 14

An Important Coal Land Hearing, possibly the most important since those involving the Cunningham group in the Bering River field, will be commenced in Seattle about June 26, when testimony will be taken in contests brought by the Department of the Interior to prevent issuance of patents to A. C. Frost, Frank H. Watson and others, who were recently tried in Chicago on criminal charges involving the same claims. They were acquitted by jury. The charges made by the Government are similar to those made in the other coal-land contests, it being alleged that the improvements made on the property are not sufficient and that the claims were staked as part of a general combination. Approximately 50,000 acres is said to be involved, variously valued. Conservation papers have placed the value at $100,000,000. Because of the sensational features which developed in the criminal trial in Chicago, the civil hearings in Seattle are expected to arouse widespread interest. Upon the completion of the local hearings, the testimony will be forwarded to the General Land Office here for decision. The decision will then be reviewed by the commissioners of the General Land Office at Washington, D. C., and possibly by the Secretary of the Interior before it finally becomes effective. The register and receiver at the General Land Office here have now under consideration the hearings upon the claims of John W. Hartline, of Tacoma, Wash., on about 2000 acres in the Bering River field not far from the Cunningham group. Inasmuch as the Government charges are the same on these claims as on the Cunningham claims the action of the land office is watched with much interest and the result of the decision on the Hartline case will tell in advance what action is to be taken on the Cunningham claims.

THE MINING NEWS

ALASKA

THE STEAMERS "SENATOR" AND "VICTORIA" returned from their first trip to Bering Sea with $1,000,000 in gold, June 23, being the first shipment from Nome this season.

THE LARGEST CARGO OF COPPER ORE ever sent from the North, 2600 tons coming from the mines at Latouche and 500 tons from Ellamar, was shipped by S.S. "Edith," which left Prince William Sound ports June 13. The ore is consigned to the Tacoma smeltery.

TOPUK DITCH CO. (Nome)—This company filed a petition in bankruptcy June 9 in the U. S. district court at San Francisco. The liabilities are stated at $386,409, of which $292,824 is for promissory notes indorsed by Henry Brantnober, of Oakland. Another large creditor is O. W. Ashby, of Tacoma, who holds a mortgage for a debt of $75,000. The mortgage covers realty in Alaska which includes mines in Daniels Creek, Cheechaco fraction and Edna fraction. The assets of the company are stated at $205,000, which covers the mining claims and property and the company store, the last valued at $5000. The company's office is in the Union Savings Bank building, Oakland, where at a meeting of the directors it was decided that the debts could not be met and that the only protection that could be offered the creditors was through voluntary bankruptcy. No decision has yet been announced as to whether or not the creditors will reopen the mines and proceed with development. W. C. Jurgens is president of the company and A. W. Corbus is secretary.

ARIZONA

Gila County

ARIZONA COMMERCIAL (Globe)—The Copper Hill shaft is finished for all present purposes of development at a depth of 1200 ft. The Aldrich vertical triplex electric pump, which is to be installed in the shaft, should arrive within a few days. Drifting from the bottom levels of the shaft is beginning.

INSPIRATION EXTENSION (Miami)—Ground has been cleared for beginning the sinking of the shaft and material for a headframe is being hauled to the ground, adjoining Inspiration Consolidated on the northwest. A 25-hp. gasoline hoist engine, formerly used at the Globe Michigan property, is being installed, and other necessary equipment will be secured immediately.

SUPERIOR & BOSTON (Globe)—Shipments have been temporarily delayed by the imperative necessity of repairs, including work on the shaft and laying of turnsheets, etc. The supply of railroad cars is normal again. No difficulty will be experienced in shipping three carloads of ore daily as soon as the repairs are finished. The pump has been installed on the 1000-ft. level. Ore extraction continues in the east and west drifts of the 660-ft. level, both faces continuing in excellent copper ore.

NEW KEYSTONE (Miami)—On May 9, it was discovered that the Inspiration company was driving an extraction drift from its Live Oak group of claims through the ground of and directly under the orebody of the New Keystone Copper Co. The management of the Inspiration declined to desist from this work, and so proceedings for an injunction were begun before the superior court in Gila County, Ariz., where the properties lie. A preliminary injunction was granted on May 27, and a further hearing was held on May 31, when the injunction was continued and the case comes up for argument in June.

INSPIRATION CONSOLIDATED (Miami) — After several months of apparent indecision it has finally been announced that a 600-ton mill to test the flotation process of extracting sulphide ores, will be built. The machinery for the mill has already been ordered, and it will be built just west of the main concentrator site. Chief engineer H. Kenyon Burch says that the machinery to be used in equipping the test mill has been so selected that it can be used in the main mill in the event the flotation process is not used. Building of the test mill will occupy six months, but construction of the concentrator will not be retarded as a result of this alteration of the original program, as the test plant will have been finished and sufficient time have elapsed for all tests necessary before that portion of the main mill's equipment shall be needed. Grading at the millsite will be finished about Aug. 15 and building will proceed as rapidly as arrival of supplies permits. Railroad grading between the mine and millsite has been finished and track has been laid. Work on the main haulage drift between the Live Oak orebody and the main east and west shafts will be discontinued probably until September, the New Keystone not yet having filed its answer to the suit instituted by the Inspiration invoking the right of eminent domain. The Inspiration test wells in the washes below the mill have proved successful, one having shown no diminution of flow when 1750 gal. per min. was pumped from it, and a second well, which will be tested early in July, seems to have an equally strong flow. The working force at the Live Oak section of the mine has been reduced considerably, presumably because of the enforced discontinuance of work in the main-haulage drift. Three churn-drill rigs are operating on the Live Oak end.

Maricopa County

VULTURE (Wickenburg)—A fire which temporarily cut off the water supply occurred recently, and the wooden derricks over the two wells were destroyed. The adjoining engine houses were also burned and one of the engines was destroyed. The other engine was not seriously damaged, and is again in commission. The large storage tanks contained a full supply of water, and no inconvenience was experienced on account of the fire. The derricks have been rebuilt.

Mohave County

TOM REED (Oatman)—The May production of this mine was about $93,000.

GOLD ROAD (Gold Road)—A bar of bullion was recently brought in from this mine, valued at $31,000. This was the clean-up from one week's operation of the mill.

FRISCO MINES & POWER CO. (Kingman)—The new 150-ton plant is in operation, and it is reported that due to certain defects in design, the mill capacity is considerably below the estimated tonnage. It is anticipated, however, that these defects will be readily remedied.

TENNESSEE (Chloride)—It is said that on the 900 level of this mine a shoot of ore ranging from 5 to 7 ft. in width has been opened. It is lead ore, although an increasing proportion of copper is being found as greater depth is reached. The ore on the 900 level contains about 4% copper. The mine is shipping about 150 tons per day to the Needles plant.

Pinal County

ARIZONA KING—The new shaft is 136 ft. deep with considerable increase in the gold in the ore. A crosscut is being driven to the foot wall. Kemper & Moore who are operating the property have secured an option on the group adjoining and propose to operate the two properties together.

AMERICAN SMELTING & REFINING CO. (Hayden)—S. J. Gormly is conducting a series of tests of the treatment of Ray Consolidated ore. On the result of the tests will be based a new long-term contract between the Ray and the smelting company. The tests will cover a period of about 60 days.

Yuma County

VENECIA—After making a series of tests on a large scale which have proved that the concentrate as well as the ore can be treated at the mine, it has been decided to erect a cyanide plant. Grading is already under way.

CALIFORNIA

Amador County

GRILLO (Volcano)—Cemented gravel has been opened up in this mine; it is expected to keep the roller mill in steady operation.

KENNEDY (Jackson)—One of the four wheels to constitute the tailing plant is practically completed. Work on the others is in progress.

PLYMOUTH CONSOLIDATED (Plymouth)—Electric power has been installed; the steam plant will be retained as auxiliary. Crosscutting on the 26-ft. level is in progress.

BUNKER HILL (Amador City)—Deepening of the shaft from the 1950 to the 2350-ft. level has been started. Two new levels will be opened. The mill output is reported to have improved in May, leaving a good margin over the payment of the 2½c. dividend.

ALPINE (Plymouth)—In addition to cleaning out and retimbering the shaft from the 500- to the 600-ft. level an aggregate of 1000 ft. of crosscuts and drifts has been driven in the present year. A good body of low-grade ore has been disclosed. Electric power is used. A 600-ft. compressor has been installed.

Calaveras County

MELONES (Melones)—A strike of a large shoot of low-grade ore is reported. A friendly suit has been filed by the Morgan mine, an adjoining property which has been recently reopened, for the purpose of settling the location of important veins over which there is contention between the two mines.

Colusa County

RUBY KING (Ladoga)—This property, generally known as a copper location, but operated as a mineral-paint mine, is to be put in working order after long idleness. The ore is iron oxide and silicate. The paint is used on railway freight cars and buildings. The mine is developed by a 1200-ft. shaft and 1000-ft. tunnel, but no copper ore has been disclosed. Ruby King Copper Co. is owner.

Inyo County

KEANE WONDER (Rhyolite, Nev.)—It is reported that several thousand tons of ore are blocked out and that the mill will be enlarged by 10 new stamps. The earnings are said to be about $15,000 per month. The controlling interest in the property has passed to Philadelphia men. Homer Wilson is manager.

Kern County

EXPOSED TREASURE (Mojave)—This old mine is being reopened; it has been idle for nine years. The water is being pumped out and the 25-stamp mill repaired and 10 stamps will be put in commission.

G. B. (Randsburg)—The 20-ton roller mill and cyanide plant are completed. The mill is equipped with two crushers and Davis rolls, and is electrically driven. There are 10 tanks in the cyanide plant. Development of the ore has been

in progress for the last three months. The oreshoot is 16 ft. wide at the 100-ft. level, and at 230-ft. depth the same width has been developed, and it is estimated that the hanging wall is four feet beyond this point.

San Bernardino County

NIXON TUNGSTEN—A Wilfley table is being installed at the Barney Osdick mill, two miles southeast of Randsburg, for concentrating the scheelite ores of this mine. Two stamps of the mill will be employed for crushing the ore. A 25-hp. gasoline engine will drive the plant. The mill is connected by pipe line with a siding on the Santa Fé branch line and water hauled in tank cars will be used. A. A. Nixon is owner of the mine.

Santa Clara County

QUICKSILVER MINING CO. (New Almaden)—New officers and directors were elected June 19, at the annual meeting, and the company is preparing to increase its working capital to the extent of $50,000 or more, through the issue of short term notes. The notes will probably bear interest at the rate of 6% and will be offered to shareholders. The directors are planning to expand operations with new reduction processes so that low-grade ore can be treated which could not be worked under methods of a few years ago. The company owns about 9000 acres of land near San José, and the quicksilver mines upon the property have been worked since 1850. The concern was a heavy producer in the '70s and '80s, and the records show that sales have aggregated $60,000,000 during the company's history. The common stock at one time paid 40% per year in dividends, but has not made any return to shareholders in many years. The new president, M. E. Harby, said that he expected to withdraw as soon as he had accomplished his purpose of broadening the activities of the company, to make place for a practical mining man. W. H. Landers, a Western mining engineer, has been placed in charge of the mines. He is a director of the company.

Trinity County

GLOBE CONSOLIDATED (Dedrick)—A new 20-stamp mill and 100-ton cyanide plant will be built. The machinery and materials are being shipped in. The new main tunnel is now in 1700 ft. and taps the vein at a distance of 600 ft. from the portal. The tunnel facilitates the working of the Chloride-Bailey mine in addition to the Globe, and will enable the company to handle low-grade ore profitably. This company has recently taken a bond on the Brown Bear at Deadwood.

BILL MARTIN (Denny)—A sawmill driven by a Pelton water wheel will be installed for sawing lumber for the construction of a flume 1½ miles long. The flume will be 3 ft. wide and 2½ ft. deep, carrying sufficient water for mining purposes. The mine was recently purchased by N. L. Tenner, of Orange Grove, N. Y., who will superintend the construction and installation of the flume and other essentials so that they will be ready for actual mining next winter when there should be a supply of water.

Tuolumne County

EAGLE-SHAWMUT (Shawmut)—High-grade ore is reported to have been disclosed at the 1600-ft. level. A new shaft is contemplated at the 400-ft. tunnel level to connect with the lower levels. A hoist placed at this level would be on a grade with the mill.

RAWHIDE GOLD MINING CO. VS. THE DUTCH MINING CO.—The suit was dismissed in the U. S. district court June 4. The suit was for $250,000 brought under the direction of W. A. Nevills, now deceased, several years ago for damages caused by water flowing from the Dutch into the App mine and for ore alleged to have been extracted from the App.

COLORADO

Clear Creek County

SEATON (Idaho Springs)—A carload of smelting ore was shipped recently that returned $75 per ton in gold and silver; 100 tons of mill dirt per week is being sent to the Argo reduction plant.

LUCKY FIND—This property, in Ohio Gulch, near Dumont, is being developed by Clark & Co., lessees. Pay ore has been opened in a raise at a point 75 ft. from the portal of the main adit.

MINERAL CHIEF—It is reported that this property on Democrat Mountain has been sold to Eastern men for $125,000, and that the new owners propose to resume development and place the 50-ton concentrating mill in operation in the near future.

ALCO—The company has awarded a contract to William Winters and Joseph Connors, of Georgetown, to sink the shaft an additional 100 ft. The vein in the bottom of the shaft is 4 in. wide and assays $70 per ton. It is planned to cut a station at the 100-ft. level and advance drifts east and west on the vein. J. J. Culley is manager.

Lake County

ONYX (Leadville)—It is reported that J. B. McDonald has found rich ore in this mine on French Mountain and that he is sacking it for shipment.

ROBERT E. LEE (Leadville)—Lessees on this Fryer Hill mine have sent out two cars of zinc-carbonate ore and the regular tonnage of iron ore of good grade.

MOUNT CHAMPION (Leadville)—The mill on this Lackawanna Gulch mine is said to be saving $1000 per day on the plates, the mill running on $5 ore. It is also stated that an oreshoot has been opened in two levels, 500 ft. in length and from 2 to 20 ft. wide. Some rich gold ore has been sent to the smelters. Manager Smith says he has enough ore in sight to keep the mill busy, for several years to come.

Summit County

BLUE FLAG (Breckenridge)—This mine shipped a carload of lead-silver concentrates recently. The mill is being enlarged to 100 tons daily capacity.

WELLINGTON MINES CO. (Breckenridge)—About 104 tons of lead-silver concentrates were shipped week before last to the Chamberlain-Dillingham sampler.

Teller County

A FOURTH DEEP-DRAINAGE TUNNEL is now looked on as a certainty to be started some time this year, and the water from the present deep tunnel, which is about 8600 gal. per min., will be used to generate power to drive the new tunnel. The recession on the deep shafts is about 7 ft. per month.

HENRY ADNEY (Cripple Creek)—This mine produced 24 carloads of unusually good ore in May, most of it coming from the main shaft. A new ore house is being built.

C. K. & N. (Cripple Creek)—Lessee M. B. Rapp, who has a two-years lease on this mine, is said to have opened the biggest oreshoot ever found in Beacon Hill and shipped 22 carloads last month.

AMERICAN EAGLES (Cripple Creek)—From this property of the Stratton Estate leased by the Colorado Mines & Investment Co. and five sets of sublessees, 17 carloads of ore were sent out in May.

W. P. H. (Cripple Creek)—In this mine on Ironclad Hill the ore developments have increased so greatly that the hoisting facilities and ore-houses have been found inadequate to handle the output, and a practically new plant is to be installed at once.

MARY McKINNEY (Anaconda)—This mine produced in May 60 carloads of good-grade ore from the main shaft on company account and 14 carloads for lessees. The oreshoot in the main workings is said to be nearly 1000 ft. in length, the longest in the camp.

DOCTOR JACK-POT (Cripple Creek)—At the annual meeting held in Cheyenne, Wyo., A. E. Carlton, of Cripple Creek was elected president and H. L. Shepherd, secretary and treasurer. The quarterly report showed the property to be in the best condition.

MODOC (Victor)—The policy of the company for the last year has been to develop the vein at greater depth and from now on the production of high-grade ore will be regular. There are two sets of lessees in the mine and five machines are working. Four carloads of ore were shipped in May from this Battle Mountain property.

STRATTONS ESTATE (Victor)—The Abe Lincoln in Poverty Gulch, another mine of the Stratton's Estate under lease to Vetter Bros., sent out 11 carloads of ore in May, and Block 239 adjoining the American Eagles leased by Caley & Pervis sent out six carloads. A strike of 3 to 6-oz. gold ore is also reported from the Longfellow mine.

IDAHO

Coeur d'Alene District

CALEDONIA VS. BUNKER HILL & SULLIVAN SUIT will be tried between Oct. 22 and Nov. 1, provided all the important witnesses have been secured by that time.

REINDEER AND COPPER QUEEN (Mullan)—It is reported that the stockholders of the Reindeer Copper Mining & Milling Co., and of the Copper Queen Mining & Milling Co., companies operating adjoining properties, will be called upon to consider a consolidation. It is proposed to capitalize a new company with 2,000,000 shares and exchange these shares for those held by the shareholders of the two companies. This will leave a large block of treasury stock from which it is anticipated funds can be derived for further development of the mines.

MICHIGAN

Copper

LAKE (Lake Mine)—Shipments of between 325 and 350 tons are being made daily yielding about 23 lb. mineral per ton. Underground conditions at the property remain unchanged and except for the scarcity of trammers a materially increased production could be mined.

ALGOMAH (Lake Mine)—The shaft at this property is nearing the fourth level, and the formation is changing, considerable native copper appearing. A crosscut is being driven west at the 200-ft. level, and has been extended about 1600 ft. but without so far finding ore.

CALUMET & HECLA (Calumet)—Work is going on at this property that will materially increase production on the Osceola amygdaloid lode. At the No. 14 shaft, the foundations are being laid for a large hoisting engine that is to be moved from No. 5 shaft of the Calumet branch on the conglomerate lode. When this engine goes into commission, the shaft will be the fourth on that lode that will be operating two compartments and will be able to handle approximately 2000 tons per day. At No. 17 shaft house, alterations have been made which brings this plant up to the point where it can handle about 1000 tons daily.

Iron

BUFFALO IRON MINING CO. (Buffalo, N. Y.)—This subsidiary of the Wickwire Steel Co., of Buffalo, has let contracts for the equipment of the new Homer mine at Iron River. Davis & Maass, of Iron River, will erect an engine house, a boiler house, a change house, and a transformer house. The buildings will be of brick and steel with corrugated iron roofing and concrete floors; the change house will be equipped with steel lockers and shower-baths. A 1300-cu.ft., electrically driven, direct-connected, Ingersoll-Rand air compressor has been ordered, and will be operated by electric power purchased from the Peninsula Power Co., of Iron Mountain. Worden-Allen Co., of Milwaukee, will erect a steel headframe, 84 ft. high; the shaft will be equipped with two skips hoisting in balance and a cage balanced by a counterweight. The first bent of the stockpile trestle will be constructed of steel. A Sullivan hoist will be used for the cage, and a Wellman-Seaver-Morgan hoist for the skips; both will be operated by compressed air. A Gould, triplex, electrically driven pump, capacity 600 gal. per min., will be installed underground. Shaft sinking continues and drifting will be started at a depth of 275 ft. The shaft was started last autumn and bedrock was reached at 120 ft. The Homer mine comprising the McGovern and Donahue properties was diamond-drilled by the Niagara Iron Mining Co., a Rogers-Brown subsidiary, several years ago, and is known to contain at least 1,000,000 tons of ore.

MISSOURI

Saint Francois County

JAKE DAY—This property on Big River is now producing three to five cars of ore per day that is assaying more than 9% lead, which is profitable in spite of the fact that the ore has to be shipped to a custom mill. For a property that has been continuously turned down by all the local men for the last 15 years, it is now more than justifying the Boston men who recently acquired it and opened it up.

MINE LA MOTTE (Mine la Motte)—This old property, which has recently been operated by Pittsburgh men, has been leased for 10 yr. to the National Lead Co., at 10% royalty, with the privilege of purchase at $800,000. While it is not a large producer, its annual output ranging from 2000 to 3000 tons of pig lead, it has usually netted from $40,000 to $60,000 per year. This property has been worked for lead for more than two centuries.

MONTANA

Butte District

OPHIR (Butte)—A number of attachments have been made on this property of the Butte Central Copper Co., situated in the southern part of the district. Writs of attachment have been issued against the company by the Anaconda Copper Mining Co. and the Montana Hardware Co., the claims aggregating about $5000. The Montana Electric Co. is also seeking to recover $844 for power and supplies sold between Jan. 26 and June 3.

Broadwater County

KEATING (Radersburg)—A rich strike is reported to have been made at this property. A shoot of ore has been opened on the 800-ft. level, the assays averaging $84 per ton in gold, and 4% copper.

Cascade County

FLORENCE (Neihart)—Development work south of the fault is opening good ore, and the company anticipates starting shipments soon. Engineers have recommended crosscutting to the Monarch vein which parallels the Florence, and it is probable that the work will be begun in the near future.

Jefferson County

BLUEBIRD (Wickes)—Wagon shipments from this property have been suspended temporarily. Shipments had been made for many months previously at a good profit, and it is believed that they will be resumed shortly.

MOUNT WASHINGTON (Wickes)—Three six-horse loads of ore are being hauled daily to the railroad from this mine. To facilitate shipping a tramway has been built to convey the ore down the steepest part of the mountain from the mine to the gulch below, where it is loaded into the wagons.

Lewis & Clark County

PIEGAN-GLOSTER (Marysville)—The Barnes-King Mining Co., which has been operating this property for some time, is driving a tunnel under the old workings and opening up a large body of low-grade ore. The management intends to install an electric plant for operating the mine machinery and for the mill.

EMPIRE (Marysville)—Edward Beadle, of Helena, has taken a lease and bond on this property and is engaged in cleaning out the upper tunnel preparatory to beginning mining operations. The mine has produced about $2,000,000 in gold, but has not been worked for several years. There is a mill on the property which will be overhauled. A considerable body of ore has been exposed in the tunnel, assaying about $13 per ton in gold, and this will be mined and milled as soon as the mill is in readiness.

Lincoln County

HAZEL T. MINING CO. (Libby)—Shanahan & Blakely, who have a contract for drifting on the vein in the Shaughnessy Hill mine, report that the entire face of the drift is in concentrating ore and that the showing in lead and silver is good.

MONTANA PLACER MINING CO. (Libby)—A force of men is at work at the Cherry Creek placer mine, 15 miles south of Libby, getting the plant in shape for operations. Repairs are being made to the flume which was built at a cost of approximately $25,000, by a company which formerly operated the property. A hydraulic elevator will be installed, the water in the old pit will be pumped out and the boxes will be repaired.

NEVADA

Comstock Lode

OPHIR (Virginia City)—Connection has been made by the raise from the 2500-ft. level, with the understope below the 2400-ft. level, and the extraction of ore has been resumed. Shipments are being made to the Kinkead mill. From a recent cleanup at the cyanide plant, six bars of bullion were shipped to the smelters, valued at $7000.

CONSOLIDATED VIRGINIA (Virginia City)—Development work on the 1000-ft. level has proceeded far enough to establish beyond further question the existence of the east vein in a region where its extension has never before been proved. Drifting southwest on the vein, there has been an improvement in its appearance, and within 200 ft. a point should be reached above the 1300-ft. level of the old shaft, where James G. Fair in 1875 reported the existence of ore of moderate grade . No records show that this ore was removed. It is certain, however, that the vein on the 1000 level has never been explored at this point, and offers substantial promise of quartz bodies.

Humboldt County

PLACER MINING in both Rochester and Limerick Cañons is giving fair returns.

PACKARD GROUP (Rochester)—A good grade of silver ore is now being mined from the opencut on this property.

CODD LEASE (Rochester)—A winze will be sunk in ore to the 100-ft. level from the tunnel level, and drifts will be driven each way. The ore will be hauled to the mouth of Limerick cañon by teams and tractors, two of the latter being now in use, and from this point across the five-mile flat to Oreana by the new narrow-gage railroad. This road will be equipped with a 50-hp. gasoline locomotive, and it is estimated that this change in the method of haulage will save $1.50 per ton in transportation costs. The first consignment of rails is now at Oreana.

Lyon County

A LEACHING PLANT, it is reported, may be erected in the Yerington district for the extraction of copper from low-grade ores. Dr. J. H. Banks, of the firm of Ricketts & Banks, of New York is now making a study of the ores and an estimate of the tonnage available in this district, with this purpose in view.

WOODBURY AND DONOVAN CYANIDE PLANTS at Silver City, are both running steadily and employing about 10 men each.

McTIGUE MILL (Silver City)—This mill is now running steadily on custom ores.

OVERLAND (Silver City)—Lessees are drifting from the shaft toward the Scheel ground. It is expected that the orebody will be cut in a short distance.

TRUCKEE RIVER GENERAL ELECTRIC CO.—Work on the extension of this company's line from the Blue Stone substation to Pine Grove has commenced.

SILVER HILL (Silver City)—This mine is now being worked by lessees. The ore, which assays from $4 to $5, is treated in the Pollard mill, where about 75% extraction is obtained on the plates. The tailings are treated in the cyanide plant.

EMPIRE-NEVADA (Yerington)—This company has resumed shipments to the smeltery. The ore is now coming from the big stope, on the Red Star claim, which was caught up after caving. Three sets of lessees are also working on this group.

MASON VALLEY MINES CO. (Thompson)—Ore receipts at the Thompson smelting plant for the week ended June 12, 1913, were as follows: From Mason Valley mine, 1920 tons; from Nevada-Douglas, 1445 tons; from other mines, 1018 tons. Total, 4383 tons, of a daily average of 626 tons. During the same week six cars of matte were shipped.

NEVADA-DOUGLAS (Ludwig)—In the Ludwig mine an oreshoot was struck on the 400-ft. level which is thought to be the same as that on the 200-ft. level. Drifting on the 800-ft. level has commenced, and will be continued for a distance of 450 ft. to a point vertically under the winze on the 700-ft. level. This winze is in ore all the way, and this ore will be ready for stoping when cut by the 800 drift. In the Douglas Hill mine a large orebody has been cut by the Texas raise which is being lifted to connect with the Winchell winze sunk from the No. 1 tunnel. In the main raise, 80 ft. above No. 2 tunnel, a large shoot of high-grade spot ore has been struck. The Keystone drill is working on the north end of Douglas Hill.

Nye County

TONOPAH MINING CO. (Tonopah)—In May, 14,954 tons were milled, of an average value of $14.73 per ton, the net profits for the month having been $92,292.

NORTH STAR (Tonopah)—On the 1050-ft. level the east drift on the downward extension of the Macdonald vein is now out 30 ft., and shows ore 12 ft. wide assaying $100 per ton. An east drift on a parallel vein is out 20 ft., and shows 4 ft. of ore assaying from $50 to $80 per ton.

WEST END CONSOLIDATED (Tonopah)—There was milled in May 4240 tons of ore for a net profit of $34,591. On the sixth level the oreshoot is now 18 ft. wide, assaying from $15 to $22 per ton, and it is estimated that in this shoot alone enough ore has now been developed to operate the mill for two years at its present capacity of 150 tons per day.

MONTANA-TONOPAH (Tonopah)—At a special meeting recently held in Tonopah it was decided to pass the dividend which was due to be paid in June. The company has $154,000 in the treasury, but having obligations to meet in connection with the building of the mill of the Commonwealth mine in Arizona, it was decided to reserve its funds for this purpose.

TONOPAH BELMONT (Tonopah)—In May 15,590 tons of ore were milled for a net profit of $181,281. Drifting on the 14th level, 1520 ft. below surface, has been started on a shoot of high-grade ore 7 ft. wide, and on the 1166-ft. level of the Shaft vein drifting east and west is in progress on a width of 6 ft. of ore assaying more than $100 per ton. During May the mill recovered 94.9% of the assay value of the ore.

HALIFAX (Tonopah)—In this mine east of the Belmont property, and which is controlled by the West End, a vein 30 ft. wide is being developed on the 1000-ft. level, having a north and south course and dipping to the east. A drift on the hanging wall of this vein has opened up 7 ft. of ore which for 30 ft. assayed $22 per ton, and is now assaying $54 per ton. Ore bins are being built, and shipments will be commenced soon.

SHIPMENTS in tons from Tonopah mines for the week ended June 14 were as follows:

Tonopah Mining	3450	North Star	250
Tonopah Belmont	3821	Mizpah Extension	....
Montana-Tonopah	957	Jim Butler	350
Tonopah Extension	1141	Tonopah Merger	100
West End	980		
Midway	....	Total	11,642
MacNamara	593	Estimated value	$254,250

NEW MEXICO

Grant County

BONNEY MINING CO. (Lordsburg)—The shaft at the property of this company is to be sunk 100 ft. deeper, which will open the mine to a depth of 112 ft. below permanent water level. O. Ryback is in charge of the work.

OREGON

Baker County

CANYON MOUNTAIN MINING CO.—The 10-stamp mill that was recently bought for this property is being installed and will soon be in operation.

IBEX (Sumpter)—This property is undergoing steady development. David Ross, manager, states that the Arthur Hill Estate, the owners, will build a mill in the near future.

Jackson County

THREE LODES (Medford)—This company is planning to build a mill and install other machinery on the property in the Galice Creek district.

STERLING (Medford)—Work will commence at once on the reconstruction of the flume at this property. Gardner Bullis will have charge of the work.

TENNESSEE

Knox County

AMERICAN ZINC CO. (Mascot)—The first unit of the mill, having a capacity of 1200 tons per day is making preliminary runs on dump-pile material. Hoisting from the mine will be begun in a few days.

UTAH

Beaver County

MOSCOW (Moscow)—The June dividend has been passed on account of extensive development work.

Juab County

TINTIC SHIPMENTS for the week ended June 13 amounted to 162 cars.

COLORADO (Provo)—Ore of a better grade than has recently been mined, has been opened on the 300- and 500-ft. levels.

EAGLE & BLUE BELL (Eureka)—The new orebody in the vicinity of the 1350-ft. level has been followed 100 ft. along the strike, and for 120 ft. vertically. About 100 tons are being mined daily.

OPEX (Robinson)—Work has been resumed from the 1700-ft. level to prospect territory adjoining the Centennial-Eureka ground. Work is also being done on the 2000, in behalf of the Middle Swansea company.

Salt Lake County

BINGHAM MINES (Bingham)—Working forces are being increased at this company's Yosemite, Brooklyn, and Commercial properties.

UTAH COPPER (Bingham)—More than 21,000 tons of ore daily was milled during May, and 10,312,600 lb. copper was produced. The total tonnage handled was the largest in the history of the company. The copper production was not proportionally large on account of the ore being of lower than average grade. Thus far in June the grade of the ore has been somewhat higher than during May, and an equally large tonnage is being handled. A lower grade of ore is mined at times, as it has been found better to send some of this through the mills rather than to rehandle several times at a loss.

ALTA CONSOLIDATED (Alta)—Connections with the Michigan-Utah tramway are to be made, and a loading station installed at the mouth of the tunnel. This work has been begun, and should be completed in the near future. There is approximately 100 tons of ore in the bins below the tunnel level, which will be hauled by wagon to the sampler at Murray. After the bins have been emptied all ore will be sent over the tramway to Tanner's Flat. The railroad, which is being built to Wasatch will reach within about 1½ miles of the tramway terminal, and it is hoped that the railroad may be induced to continue the spur up the cañon to Tanner's Flat.

Tooele County

LION HILL CONSOLIDATED (Ophir)—Development along the Gladstone fissure has opened ore of a better grade, carrying silver.

OPHIR HILL (Ophir)—This property at Ophir was recently visited by W. A. Clark and his son. The mill is handling 200 tons of ore daily.

CONSOLIDATED MERCUR GOLD MINES (Mercur)—A final dividend of 3c. per share has been declared payable June 25. This calls for $30,000, bringing the total to date for this company to $1,265,000. The funds for the last dividend were obtained from a cleanup around the big mill, which was shut down when the mine was exhausted a few months ago. There remains much machinery to be disposed of, and another dividend is probable before the company finally winds up its affairs. The Consolidated Mercur employed 600 or 700 men. Two smaller mills are now in operation in the camp.

WASHINGTON

Stevens County

CHEWELAH COPPER KING—S. P. Domer was elected president of this company at the recent annual meeting. The mine is equipped with modern machinery, and as soon as electric power can be secured a mill will be built.

WISCONSIN

Grant County

CLEVELAND (Hazel Green)—This company is drilling the Burns land, embracing the old "Hazel Green" mine workings.

SMELSER (Platteville)—Jack was struck in the second drill hole at a depth of 80 ft. on the L. L. Harms land just east of the Beloit-Elmo.

ENTERPRISE (Platteville)—Mining rights and equipment have been purchased by H. E. Stephens and Charles Kistler, who are drilling the tract; this was the first deep zinc mine of the district and has been a big producer and dividend payer.

CANADA

British Columbia

CONSOLIDATED MINING & SMELTING CO. (Rossland)—The shafthouse at the War Eagle mine, of the Center Star group, together with other buildings in close proximity, was recently destroyed by fire. The loss is estimated at not less than $50,000, but this will be partly covered by insurance. Beside the shafthouse and many dry mine-timbers that were in it, the ore bins and tankhouse close by were burned. Bulkheads were promptly put in the shaft at the 100- and 200-ft. levels, which precaution and a good supply of water prevented the fire from getting more than 25 ft. down the shaft. Ore hoisting from the War Eagle mine is done through the Center Star main shaft, so that production will not be seriously interfered with. During recent years the War Eagle shaft has been used chiefly for lowering and hoisting men and materials. The shafthouse was built in 1893, when J. B. Hastings was manager.

Ontario

SILVER HORN (Elk Lake)—This mine, which has been closed down for some time, is again being operated.

REA (Porcupine)—A small mill installed by the leasing company, having a capacity of 20 tons per day, has started work.

PEARL LAKE (Schumacker)—The main shaft is now down 735 ft. and it is expected that the 800-ft. level will be reached and the vein picked up in about four weeks.

KEELEY (South Lorrain)—At this mine, now owned by the English firm of Ehrlich & Hamilton, a 3-in. vein of high-grade ore has been cut on the 50-ft. level and opened up for a fair distance.

DOME (South Porcupine)—The directors have decided not to make the new issue of stock authorized by the shareholders. The addition of 60 stamps to the mill will be financed out of the profits of production.

WORTHINGTON CLAIMS (Ogden)—On this property one shaft is down 85 ft. in ore carrying visible gold. Another, 1000 ft. distant, has been put down 35 ft. in sulphide ore, some assays of which show high-grade ore.

HOLLINGER (Schumacker)—During the four-weeks period ended May 30, the mill only ran 49% of the possible running time owing to the breaks at the power plants. The tonnage treated was 6550 tons and the average value of ore $17.53 per ton, as compared with 11,357 tons of an average value of $23.44 per ton during the preceding 4-weeks period.

GOLDFIELDS LTD. (Larder Lake)—At the plant of this company 40 stamps are in operation on ore taken from the opencut at the 60-ft. level, where the low-grade ore is 50 ft. wide. A shaft is being sunk another 100 ft. The gold is as yet being recovered only by amalgamation and the ore being refractory a low extraction is made. The tailings are saved for retreatment and tube mills and cyanide plant have been ordered.

McKINLEY-DARRAGH-SAVAGE (Cobalt)—The production in May was 206,781 oz. of which 42,662 oz. came from the Savage mine. The Swamp veins of the McKinley were the heaviest producers. The aërial tramway connecting the Savage mine with the mill was started in operation, and 75 tons of ore daily is being carried over it from the dumps, where many thousand tons of low grade have been accumulated. The new mill has been started and a total of 50 stamps and three tube mills are now in operation.

SHIPMENTS of ore and concentrates in tons, from Cobalt for the week ended June 20 were as follows:

Bailey	.....	La Rose	50.00
Beaver	.....	Lost and Found	.....
Buffalo	.....	McKinley-Darragh	63.04
Casey Cobalt	.....	Nipissing	64.91
Chambers-Ferland	.....	Nipissing Reduction	.....
City of Cobalt	.....	O'Brien	.....
Cobalt Lake	31.55	Penn.-Canadian	.....
Cobalt Townsite	25.09	Provincial	.....
Colonial	.....	Right of Way	.....
Coniagas	.....	Seneca Superior	.....
Crown Reserve	20.00	Silver Bar	.....
Dominion Reduction Co.	.....	Silver Cliff	.....
Drummond	.....	Timiskaming	31.21
General Mines	.....	Trethewey	.....
Green Meehan	.....	Wettlaufer	.....
Hargraves	.....	York	.....
Hudson Bay	32.29		
Kerr Lake	.....	Total	318.09

MEXICO

Mexico

EL ORO MINING & RY. CO. (El Oro)—In May, 23,830 tons of ore and 14,190 tons of tailings were treated, yielding $227,360 at an estimated net profit of $92,950, $5680 of which was from the railroad.

SOUTH AMERICA

Colombia

CERTIGUE MINING & DREDGING CO. (New York, N. Y.)—It is reported from Barranquilla that this company has been granted time extension for continuing work on the Quito and Certigue Rivers because of the delays to which its development and exploratory work have been subjected from causes beyond its control. Last December the company's dredge was sunk during a flood of the Certigue River.

AFRICA

Transvaal

GOLD PRODUCTION IN THE TRANSVAAL in May was: Witwatersrand, 761,349 oz.; outside districts, 32,957; total, 794,306 oz. This is 9332 oz. more than in April, and 14,644 oz. more than in May, 1912. For the five months ended May 31 the total was 3,634,706 oz. in 1912, and 3,892,344 oz.—or $80,475,420—in 1913; an increase of 258,638 oz. this year.

THE MARKET REPORT

METAL MARKETS

NEW YORK—June 25

The metal markets have been inclined to be slow and dull. Prices have been rather weak, with the exception of one or two lines.

Copper, Tin, Lead and Zinc

Copper—It looks very much as though the selling pressure which had its origin in Europe culminated this week with the extreme of the decline in the standard market, from which low level there was a substantial rally. A great many buyers came forward and in consequence the cheap lots of electrolytic copper which have been offered in the European market should by this time be fairly well absorbed. There have also been some signs of awakening interest among domestic buyers, with whom some moderate quantities of copper were placed during the week, mostly at low prices. Manufacturers are gradually running through their copper coming in under previous contracts, and unless they contemplate retirement from business they will have to buy largely in the near future, but they will no doubt put off their buying until the last moment. Recognizing the soundness of the situation the largest American producers have exerted no pressure on the market, and during the last week certain agencies, which heretofore have been selling freely, withdrew their offerings, awaiting a better price. The largest Lake companies have been out of the market for a long while and quotations for Lake have been more or less nominal, representing only the occasional business transacted by second-hands and by some of the smaller producers. At the close the market is distinctly more cheerful at 14.56@14.75c. for Lake copper and 14.40@14.45c. for electrolytic copper in cakes, wirebars or ingots. Casting copper is quoted nominally at 14.20@14.25c. as an average for the week.

In London, the market on Monday declined to £62 17s. 6d. for spot and £63 for three months, a drop of over £2 since the close reported last week, but there has been a sharp rally and the close is firmer at £64 5s. for spot and £64 10s. for three months.

Base price of copper sheets was reduced 1c. per lb. in June 23, and is now 20c. per lb. for hot rolled and 21c. for cold rolled. Full extras are charged, and higher prices for small quantities. Copper wire is quoted at 16c. per lb., for carload lots at mill.

Tin—The market had to stand the brunt of very heavy liquidation on Friday of last week, as well as Monday of this week. Quotations on these two days declined almost £12 per ton. Assistance came on Tuesday, when heavy buying, said to originate with the Vienna Syndicate, gave strong support to the market. American consumers were rather frightened by the abrupt decline and did not take advantage of the same to make purchases of cheap material. Dealings were confined to traders. Spot material seems to be concentrated in a few hands and held at a small premium. No low offers of spot tin were made at any time during the deroute in the market. The market closes strong and confidence in the metal is expressed in the three months' quotation, which at the close is 15s. above that for spot. The London quotations are £202 for spot and £202 15s. for three months' prompt, and New York is 44¾ cents.

Lead—The market is unchanged at 4.30@4.35c. New York and 4.17½@4.20c. St. Louis.

The London market has been subject to wide fluctuations, due to the extreme scarcity of spot lead. Future months can be had at a decided discount. After advancing to £21 10s. on June 19 and 20, there was a drop in the market to £20 on June 21, and at the close, a reaction set in, which brought the market back to £20 15s. for Spanish lead and 7s. 6d. more for English.

Spelter—The action of the Senate in fixing the duty on spelter at 15% ad valorem has stimulated interest in the metal. There has been a very good business doing for both near-by and future shipments in which consumers and speculators participated. As a result, prices, for the first time in a number of weeks, show an advance, and the close is firmer at 5.10@5.20c. New York and 4.95@5.05c., St. Louis.

The market in Europe is reported extremely weak. There has been a further decline of over £1 since last Wednesday, and it is feared that no permanent improvement can be looked for until prices reach a level which will bring about a distribution of the very large stocks which have accumulated in the hands of the Zinc Convention. It remains to be seen whether this process will result in establishing a level in the foreign market which will endanger the position here. The close is weak at £20 15s. for good ordinaries and £23 7s. 6d. for specials.

Base price of zinc sheets in carload lots is $7.25 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

Aluminum—The market is entirely unsettled by the tariff discussion. The action of the Senate committee in reducing the duty to 2c. per lb. is generally expected to pass. Meantime there is very little business doing, buyers taking only what is needed. Domestic metal is bringing about 23½@24c. per lb. for No. 1 ingots. Foreign metal sells only in bond just now, bringing about 19c., ex-duty.

DAILY PRICES OF METALS

NEW YORK

June	Sterling Exchange	Silver	Copper		Tin	Lead		Zinc	
			Lake, Cts. per lb.	Electrolytic, Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
			14.55	14.55		4.30	4.17½	5.05	4.90
19	4.8670	58⅜	@14.75	@14.65	45	@4.35	@4.22½	@5.10	@4.95
			14.50	14.45		4.30	4.20	5.05	4.90
20	4.8660	58⅛	@14.75	@14.55	43⅜	@4.35	@4.25	@5.15	@5.00
			14.50	14.45		4.30	4.17½	5.05	4.90
21	4.8675	58¼	@14.75	@14.55	43⅜	@4.35	@4.22½	@5.15	@5.00
			14.50	14.35		4.30	4.17½	5.10	4.95
23	4.8680	58	@14.75	@14.45	42½	@4.35	@4.20	@5.20	@5.05
			14.50	14.40		4.30	4.17½	5.10	4.95
24	4.8680	57⅞	@14.75	@14.45	43¼	@4.35	@4.20	@5.20	@5.05
			14.50	14.40		4.30	4.17½	5.10	4.95
25	4.8680	58¼	@14.75	@14.45	44¼	@4.35	@4.20	@5.20	@5.05

The quotations herein given are our appraisal of the market for copper, lead spelter and tin based on wholesale contracts with consumers without distinction as to deliveries; and represent, to the best of our judgement, the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. below that of electrolytic. We quote casting copper at 0.15c. below the price for electrolytic. The quotations for lead represent wholesale transactions in open market for good ordinary brands, both desilverized and non-desilverized; the specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium. Silver quotations are in cents per troy ounce of fine silver.

LONDON

June	Silver	Copper			Tin		Lead, Spanish	Zinc, Ordinaries
		Spot	3 Mos	Best Sel'td	Spot	3 Mos		
19	26⅞	64¾	64⅞	70¾	204¾	205	21⅛	22¼
20	26 11/16	63½	63½	69½	198½	198½	21⅛	21¼
21	26⅞	....	....	....	....	....	....	....
23	26¾	62⅞	63	68½	193	193¾	20	21
24	26⅞	63⅛	64	69	197½	198	20½	21
25	26 11/16	64⅛	64⅛	69⅛	202	202¾	20¾	20¾

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c.; £15 = 3.26c. = £25 = 5.44c.; £70 = 15.22c. Variations, £1 = 0.21¾c.

Nickel—Shot, block and plaquettes are quoted at 40@45c. per lb., according to quality and size of order. Electrolytic nickel is 5c. per lb. higher.

Selenium—Producers of this metal quote large lots at $2.75@3.50 per lb., according to size of order; while as high as $4.50@5.50 is paid for retail lots.

Gold, Silver and Platinum

Gold—The price of gold on the open market in London remained at 77s. 9d. per oz. for bars and 76s. 4d. per oz. for American coin. Most of the supplies arriving from South Africa were taken for German account.

Sales of gold bars from the United States Assay Office in New York, in May, were $2,873,334. These sales are to jewelers and others for use in the arts. For the five months ended May 31, the total sales were $11,596,023 in 1912, and $14,168,801 in 1913; an increase of $2,572,778 this year.

Gold in the United States, June 2, is estimated by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $1,079,407,169; in Treasury current balances, $171,958,297; in banks and circulation, $610,004,429; total, $1,861,369,895, a decrease of $5,717,190 during May.

Iridium—Conditions in this metal are unchanged, and prices are high, dealers asking $85 per oz., New York.

Platinum—The market is quiet and steady, with no change in prices. Refined platinum brings $45@46 per oz., while $49@52 per oz. is paid for hard metal.

The latest London quotation is £9 5s. per oz. which is equal to $45. Business is reported good abroad.

Silver—The market has been quiet with lower tendency the past week, due to tight money conditions in London. Reports from India say that the Monsoon conditions are favorable so far, and if this continues and money rates get easier, an improvement in prices for silver is probable.

Exports of silver from London to the East, Jan. 1 to June 12, reported by Messrs. Pixley & Abell:

	1912	1913	Changes
India	£2,999,800	£3,423,000	I. £423,200
China	853,500	309,500	D. 544,000
Total	£3,853,300	£3,732,500	D. £120,800

Imports of silver at New York, week ended June 21 were $116,389, from Mexico and South America; exports were $982,881, nearly all to London and Paris.

Coined silver in the United States, June 2, as estimated by the Treasury Department: Standard dollars, $565,590,020; subsidiary coins, $175,299,876; total, $740,889,896. Of the dollars, $483,067,000 are held in the Treasury against silver certificates.

Zinc and Lead Ore Markets

JOPLIN, MO.—June 21

The high price of zinc blende is $45, the base per ton of 60% zinc ranging from $40 to $43. Calamine sold on a base of $20@23 per ton of 40% zinc. The average of all grades is $40.40 per ton. Despite the sharp foreign advance local lead prices have not responded, and price quotations are unchanged at $52.50 per ton of 80% metal contents, and the average of all grades is $52,28 per ton.

SHIPMENTS WEEK ENDED JUNE 21

	Blende	Calamine	Lead ore	Value
Totals this week ..	9,465,640	478,920	1,750,740	$246,725
Totals 24 weeks ..	272,678,400	18,420,890	45,832,060	$7,641,682

Blende value, the week, $195,229; 25 weeks, $6,196,046.
Calamine value, the week, $5718; 25 weeks, $240,840.
Lead value, the week, $45,778; 25 weeks, $1,204,796.

PLATTEVILLE, WIS.—June 21

The base price paid this week for 60% zinc ore was $42 per ton. The base price paid for 80% lead ore was $52@53 per ton.

SHIPMENTS WEEK ENDED JUNE 21

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	3,321,560		981,950
Year to date	70,333,300	3,379,870	30,138,780

Shipped during week to separating plants, 2,718,060 lb. zinc ore.

OTHER ORE MARKETS

Tungsten ore continues in fair demand. High-grade molybdenum ore is also in demand, but there is a surplus of low-grade ore. Vanadium ore is quiet, with light sales.

IRON TRADE REVIEW

NEW YORK—June 25

Full operation of the steel mills continues to furnish impressive proof that the business booked in the great buying movement of many months ago was of the soundest character. Cancelations and postponements are of negligible amount, and the majority of the large mills seem in position to run almost to the close of the year upon business now on books. Specifications received against contracts continue to average 60 or 70% of shipmente. New buying has shown a slight increase in some quarters, comparing June with May. In tubular goods specifications have considerably exceeded shipments in the past 30 days.

Reports of price cutting in plates and shapes are not generally credited, and at the most they refer only to eastern mills, which were obtaining large premiums six months ago, and did not book forward business. Galvanized sheets are a trifle easier, and wire products show no market, at all, buyers awaiting the downward adjustment of prices which is frequently made at this time of year.

Steel makers are taking a much more optimistic view of the future than formerly. They believe the present apathy of buyers is liquidating all unfavorable influences, particularly the tariff revision, and therefore expect the continued strength of the steel position to result in a buying movement of sufficient proportions to take up the slack which would otherwise develop later in the year.

Pig iron seems to be in better demand, though it is owned that there are many inquiries that do not result in business. Prices are rather weak, though merchant furnaces are not willing to make any further concessions.

The Interstate Commerce Commission has ordered a reduction in rates on coke from the Connellsville coke region. It has also ordered that the rates be kept down in future. The rate from Pittsburgh to points in the Shenango Valley is not touched, being entirely within Pennsylvania.

The commission has also ordered the ore rates to Pittsburgh and points in the valleys to be equalized. It has ordered that hereafter the rates to Pittsburgh and Wheeling should be the same. The rate from the Lake ports has been 96c. to Pittsburgh and 60c. to Wheeling, and this the commission calls discrimination. The new rate is not prescribed, but there must be no difference between the two places.

Exports and Imports in Great Britain of iron and steel and manufactures thereof, four months ended Apr. 30, are valued as below by the Board of Trade returns:

	Exports	Imports	Excess
Iron and steel	18,341,167	5,236,759	Exp. 13,104,408
Machinery, hardware, etc.	18,838,017	5,260,860	Exp. 13,577,157
Total	37,179,184	10,497,619	Exp. 26,681,565
Total	31,633,808	8,552,339	Exp. 23,081,469

Quantities of iron and steel exported are given at 1,574,918 tons in 1912 and 1,636,503 in 1913; quantities imported were 574,379 tons in 1912, and 766,520 tons this year.

PITTSBURGH—June 24

Last Friday an agreement was reached to govern skilled wages in the sheet and tin mills controlled by the Amalgamated Association, the workers and manufacturers being in conference at West Baden, Ind. In the tin-plate scale heaters were given an advance of 5%, while in the sheet mill scale the matchers and doublers were given 10% and in the jobbing mill scale the second catcher was given 5%. Only about 11% of all the tin mills and about 22% of all the sheet mills are governed by the union scales. The American Sheet & Tin Plate Co. has been entirely non-union since 1909. The Phillips Sheet & Tin Plate Co., which signed the scale for its Steubenville tin plate plant last year, has declared its intention to operate the mill open.

The feeling in Pittsburgh steel circles continues to be relatively optimistic. It is felt that the mills are so well booked with business—exemplified by their continued full operation in face of light new buying—that enough new buying can easily occuh after midsummer to carry the situation through the year. There will be fewer closings for repairs in July than was expected 30 days ago. Most of the steel mills will close only for Friday, Independence Day, and Saturday, while a few finishing mills will close for one or two weeks.

Pig Iron—Pig iron prices continue to show the greater resistance to decline that was noted a week ago, but they have tended to decline nevertheless, quoted prices this week

being lower by 25c. on foundry, and 50c. on bessemer. Sales of foundry iron in the past fortnight total over 5000 tons, chiefly in 500-ton lots, a better showing than for many weeks. An unfavorable feature, however, is that buyers are taking smaller tonnages than expected, and hence are withdrawing from the market without having supported it as much as expected by their purchases. We quote: Bessemer, $16; basic, $14.50; malleable, $14.25; No. 2 foundry, $14; forge, $13.75; f.o.b. Valey furnaces, 90c. higher delivered Pittsburgh.

Ferromanganese—Sales of prompt lots, generally carloads to 100 tons, have been made at about $1 a ton lower than formerly quoted, and it is possible the contract price could be shaded, though this is not developed as there is practically no inquiry, pending settlement of the tariff. The trade has been at sea, since the House bill provided a large increase in the ferromanganese duty, while now the Senate seems disposed to place it on the free list. We quote prompt at $59 and contract nominal at $61, Baltimore, freight to Pittsburgh being $2.16 per ton.

Steel—The market is extremely quiet, with mills firm at former quotations for forward delivery. Prompt lots would doubtless command a premium, as steel is scarce, but there is no demand. We quote forward unchanged at $26.50@27 for billets and $27@27.50 for sheet bars, maker's mill, Pittsburgh or Youngstown. Rods remain at $29, Pittsburgh.

IRON ORE

The Alan Wood Iron & Steel Co. has contracted with the Canadian-Venezuelan Ore Co. for 50,000 tons of Imataca ore, in addition to its existing contract. The price is said to be a shade under 8c. per unit, f.o.b. dock, Philadelphia.

Imports of iron ore into Great Britain five months ended May 31 were 2,313,281 long tons in 1912, and 3,377,144 in 1913; increase, 1,063,863 tons. Imports of manganese ore were 118,676 tons in 1912, and 298,455 in 1913; increase, 179,779 tons.

COKE

Coke production and shipments in the Connellsville region hold up well, and there are no signs of slackening immediately. The deadlock on second-half contracts continues, and producers still decline to meet the views of the furnace owners on prices.

Exports of Fuel from Great Britain four months ended Apr. 30 were: Coal, 23,589,878; coke, 352,390; briquettes, 691,347; coal sent abroad for the use of steamships in foreign trade, 6,747,177; total, 31,380,792 long tons. This is an increase of 11,836,387 tons, or 60.6% over the total last year, when the trade was almost suspended for a time, owing to the general strike of miners.

Coal and Coke Tonnage of Pennsylvania R.R. lines east of Pittsburgh and Erie five months ended May 31, short tons:

	1912	1913	Changes
Anthracite	3,688,943	4,641,994	I. 953,051
Bituminous	18,956,936	20,092,450	I.1,135,514
Coke	5,340,912	6,225,387	I. 884,475
Total	27,986,791	30,959,831	I.2,973,040

The total increase this year was 10.6%; the largest proportional gain being in anthracite.

Exports and Imports of Fuel in the United States, four months ended Apr. 30 are reported as follows, in long tons:

	Exports		Imports	
	1912	1913	1912	1913
Anthracite	811,259	1,141,903	30	13
Bituminous	3,512,062	4,234,477	488,651	535,860
Coke	258,305	326,990	27,867	22,163
Bunker coal	2,562,312	2,318,426	.....	.....
Total	7,143,938	8,021,796	516,548	558,036

Increase in exports 877,858 tons, or 12.3%; increase in imports, 41,488 tons, or 8%. The bunker coal, or coal furnished to steamships in foreign trade, is practically all bituminous. The heaviest exports are to Canada, while that country also furnishes a large share of the imports. The imports are mainly on the Pacific Coast.

CHEMICALS

NEW YORK—June 25

The general market is quiet as the midsummer season is approaching, and only a moderate amount of business is doing.

Arsenic—The market is dull. There is little demand from the makers of insecticides. Prices are weaker, current quotations being $3.25@3.37½ per 100 lb.; a figure at which there is very little profit.

Copper Sulphate—Trade is only moderate, but prices are steady at $5.25 per 100 lb. for carload lots and $5.50 per 100 lb. for smaller parcels.

Nitrate of Soda—The market has fallen into summer dullness and business is quiet. Quotations are easier, 2.45c. per lb. being named for spot; 2.40c. per lb. for July and later deliveries.

PETROLEUM

Exports of mineral oils from the United States in May were 170,425,349 gal. For the five months ended May 31 the total exports were 720,476,215 gal. in 1912, and 750,383,794 in 1913; an increase of 29,907,579 gal., or 4.2%, this year.

COPPER SMELTERS' REPORTS

This table is compiled from reports received from the respective companies, except in the few cases noted (by asterisk) as estimated, together with the reports of the U. S. Dept. of Commerce as to imported material, and in the main represents the crude copper content of blister copper, in pounds. In those cases where the copper contents of ore and matte are reported, the copper yield ther is reckoned at 97%. In computing the total American supply duplications are excluded.

	Jan.	Feb.	March	April	May
Alaska shipments	1,668,328	660,250	472,293	1,730,252	1,771,508
Anaconda	21,000,000	21,250,000	22,900,000	23,800,000	25,600,000
Arizona, Ltd.	3,100,000	3,000,000	3,200,000	3,100,000	3,200,000
Copper Queen	7,554,966	6,810,706	7,558,709	8,210,166	8,301,605
Calumet & Ariz.	4,750,000	4,050,000	4,250,000	4,500,000	4,300,000
Chino	3,298,030	3,898,998	4,464,723	3,925,409	3,883,611
Detroit	1,769,071	1,689,277	1,640,671	1,856,517	2,001,633
East Butte	1,469,000	1,325,000	1,400,000	1,400,000	.....
Mammoth	1,957,804	1,661,150	1,641,091	1,450,000	1,700,000
Giroux	650,000	*600,000	*625,000	*600,000	.....
Mason Valley	1,655,319	1,348,070	1,608,492	1,264,304	.....
Miami	.....	.....	.....	.....	1,943,900
Nevada Con.	4,169,705	4,798,537	5,555,320	5,650,608	5,933,275
Ohio	492,760	380,849	596,651	690,001	.....
Old Dominion	2,727,000	2,381,000	2,853,000	3,040,000	2,749,000
Ray	3,610,000	3,610,000	4,287,400	4,379,128	4,384,400
Shannon	1,232,000	1,152,000	1,260,000	1,238,000	1,080,000
Tennessee	1,824,637	1,600,151	1,796,394	1,718,188	.....
United Verde*	2,900,000	2,750,000	3,000,000	3,000,000	.....
Utah Copper Co.	7,333,495	7,585,303	8,248,880	9,539,847	10,003,227
Lake Superior*	17,500,000	19,000,000	19,000,000	17,000,000	18,750,000
Non-rep. mines*	5,675,363	5,399,849	6,203,606	6,000,000	6,200,000
Total prod.	96,337,478	94,950,141	102,562,230	104,092,420	.....
Imports, bars, etc.	34,026,236	21,372,292	24,215,480	25,578,297	.....
Total blister	130,363,714	116,318,433	126,777,710	129,670,717	.....
Imp. ore & matte	7,563,758	9,459,432	11,911,041	7,177,363	.....
Total Amer.	137,927,472	125,781,865	138,688,751	136,848,080	.....
Miami†	2,932,369	2,817,200	3,102,200	2,312,900	.....
Shattuck-Arizona	1,381,422	1,136,480	1,234,450	1,158,326	1,026,170
Brit. Col. Cos.:					
British Col. Cop.	720,260	688,312	844,735	794,000	.....
Granby	1,792,245	1,740,000	1,967,962	1,857,452	1,782,570
Mexican Cos.:					
Boleo†	2,658,880	2,535,680	2,204,720	2,811,200	2,424,800
Cananea	5,450,000	4,880,000	4,772,000	3,581,690	2,272,000
Moctezuma	2,913,294	2,730,914	3,062,159	2,753,240	2,695,881
Other Foreign:					
Braden, Chile	1,484,000	1,178,000	1,472,000	1,512,000	1,150,000
Cape Cop., S. Af.	770,540	712,320	732,480	586,880	387,520
Kyshtim, Russia	1,644,160	1,352,960	1,478,400	2,544,640	.....
Spassky, Russia	974,400	1,003,520	974,400	974,400	.....
Exports from Chile	6,752,000	5,824,000	7,840,000	7,616,000	3,584,000
Australia	9,744,000	5,512,000	6,944,000	6,608,000	7,840,000
Arrivals—Europ‡	17,689,280	8,509,760	15,585,920	10,545,920	13,661,760

† Boleo copper does not come to American refiners. Miami copper goes to Cananea for treatment, and reappears in imports of blister. From May 1, Miami copper is refined in the U. S. and appears under American mines.

‡ Does not include the arrivals from the United States, Australia or Chile.

STATISTICS OF COPPER

	United States			Visible Stocks.		
Month	U.S.Refin'y Production	Deliveries, Domestic	Deliveries, for Export	United States	Europe	Total
V, '12	126,737,836	72,702,277	69,485,945	65,066,029	134,176,000	199,242,029
VI	122,315,240	66,146,229	61,449,650	49,615,643	117,801,600	167,417,244
VII	137,161,129	71,094,381	60,121,331	44,335,004	108,186,000	152,521,003
VIII	145,628,521	78,722,418	70,485,150	50,280,421	113,299,200	163,579,621
IX	140,089,819	63,460,810	60,264,796	46,701,374	113,568,000	160,269,374
X	145,405,453	84,104,734	47,621,342	63,065,587	107,408,000	170,473,587
XI	134,695,400	69,369,795	55,906,550	76,744,964	103,801,600	180,546,564
XII	143,354,042	58,491,723	65,713,796	86,164,059	96,947,200	183,111,259
Year, 1912	1,581,920,287	819,665,948	746,396,452	.....	.....	.....
I, 1913	143,479,625	65,210,030	60,383,845	105,312,582	78,491,840	183,904,422
II	130,948,881	59,676,492	72,168,523	123,198,332	77,504,000	200,702,332
III	136,251,849	76,585,471	77,699,306	122,302,890	81,244,800	203,547,690
IV	135,353,402	78,158,837	85,894,727	104,269,270	87,180,800	191,450,070
V	141,319,416	81,108,321	68,285,978	75,549,108	85,948,800	161,497,908
VI	.....	.....	.....	67,474,225	77,235,200	144,709,425

Note—From Jan. 1, 1913, visible supplies in Europe do not include copper afloat.

Assessments

Company	Delinq	Sale	Amt.
Arlington, Ida.	July 3	Aug. 4	$0.302
Aurora-Sampson, Ida.	June 16	July 16	0.002
Big Elk, Ida.	June 10	July 10	0.001
Cedar Creek, Ida.	May 3	July 3	0.005
Central Eureka, Calif.	June 6	July 5	0.02½
East Hecla, Ida.	June 18	July 25	0.003
Giant M. & D. Co.	June 17	July 17	0.001
Houghton Copper, Mich.	.....	July 15	1.00
Hypotheek, Ida.	June 20	July 14	0.004
Imperial M. & M., Ida.	June 2	July 21	0.002½
Imperial Mg., Ida.	June 10	July 15	0.002½
Lone Star, Nev.	May 29	July 3	0.01
Middle Swansea, Utah.	June 12	July 3	0.001
Mineral Farm, Ida.	June 7	July 7	0.002
New Arcadian, Mich.	.....	July 1	0.50
Old Evergreen, Utah.	June 17	July 17	0.01
Oreano, Ida.	June 9	July 9	0.001
Samson, Ida.	May 1	July 1	0.002
Sierra Nevada, Nev.	June 24	July 15	0.10
Silver Flat, Utah.	June 23	July 7	0.001
Silver Moon, Ida.	June 2	July 26	0.005
Silver Pick, Nev.	June 23	July 28	0.01
Sunset Dev., Ida.	June 16	July 10	0.001
Tintic Standard, Utah.	June 21	July 19	0.005
Tuscumbia, Ida.	Apr. 26	July 10	0.001
Union Chief, Utah.	.....	.....	0.01
Wonderful, Ida.	June 10	July 10	0.001

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1911	1912	1913	1911	1912	1913
January	53.795	56.260	62.938	24.865	25.887	28.983
February	52.222	59.043	61.642	24.081	27.190	28.357
March	52.745	58.375	57.870	24.324	26.875	26.669
April	53.325	59.207	59.490	24.595	27.284	27.416
May	53.308	60.880	60.361	24.583	28.038	27.825
June	53.043	61.290	.....	24.486	28.215	.....
July	52.630	60.654	.....	24.286	27.919	.....
August	52.171	61.606	.....	24.082	28.375	.....
September	52.440	63.078	.....	24.209	29.088	.....
October	53.340	63.471	.....	24.594	29.299	.....
November	55.719	62.792	.....	25.649	29.012	.....
December	54.905	63.365	.....	25.349	29.320	.....
Year	53.304	60.835	.....	24.592	28.042	.....

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York				London, Standard	
	Electrolytic		Lake			
	1912	1913	1912	1913	1912	1913
January	14.094	16.498	14.337	16.767	62.760	71.741
February	14.084	14.971	14.329	15.253	62.893	65.519
March	14.698	14.713	14.868	14.930	65.884	65.329
April	15.741	15.291	15.930	15.565	70.294	68.111
May	16.031	15.436	16.245	15.738	72.352	68.867
June	17.234	.....	17.443	.....	78.259	.....
July	17.190	.....	17.353	.....	76.636	.....
August	17.498	.....	17.644	.....	78.670	.....
September	17.508	.....	17.698	.....	78.762	.....
October	17.514	.....	17.661	.....	76.389	.....
November	17.326	.....	17.617	.....	76.890	.....
December	17.376	.....	17.600	.....	75.516	.....
Year	16.341	.....	16.560	.....	72.942	.....

New York, cents per pound, London, pounds sterling per long ton of standard copper.

TIN

Month	New York		London	
	1912	1913	1912	1913
January	42.529	50.298	191.519	238.273
February	42.962	48.766	195.036	220.150
March	42.577	46.832	192.619	213.645
April	43.923	49.115	200.513	224.119
May	46.063	49.038	208.830	224.143
June	45.815	.....	205.863	.....
July	44.519	.....	202.446	.....
August	45.857	.....	208.351	.....
September	49.135	.....	223.762	.....
October	50.077	.....	228.353	.....
November	49.891	.....	227.619	.....
December	49.815	.....	226.875	.....
Av. year	46.096	.....	209.322	.....

New York in cents per pound; London in pounds sterling per long ton.

LEAD

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	4.435	4.321	4.327	4.171	15.597	17.114
February	4.026	4.325	3.946	4.175	15.738	16.550
March	4.073	4.327	4.046	4.177	15.997	15.977
April	4.200	4.381	4.118	4.242	16.331	17.597
May	4.194	4.342	4.072	4.226	16.509	18.923
June	4.392	.....	4.321	.....	17.588	.....
July	4.720	.....	4.603	.....	18.544	.....
August	4.569	.....	4.452	.....	19.655	.....
September	5.048	.....	4.924	.....	22.292	.....
October	5.071	.....	4.894	.....	20.630	.....
November	4.615	.....	4.463	.....	18.193	.....
December	4.303	.....	4.152	.....	18.069	.....
Year	4.471	.....	4.360	.....	17.929	.....

New York and St. Louis cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1912	1913	1912	1913	1912	1913
January	6.442	6.931	6.292	6.854	26.642	26.114
February	6.499	6.239	6.349	6.089	26.661	25.338
March	6.626	6.078	6.476	5.926	26.048	24.605
April	6.633	5.641	6.483	5.491	25.644	25.313
May	6.679	5.406	6.529	5.256	25.790	24.583
June	6.877	.....	6.727	.....	25.763	.....
July	7.116	.....	6.966	.....	26.174	.....
August	7.028	.....	6.878	.....	26.443	.....
September	7.454	.....	7.313	.....	27.048	.....
October	7.426	.....	7.276	.....	27.543	.....
November	7.371	.....	7.221	.....	26.804	.....
December	7.162	.....	7.081	.....	26.494	.....
Year	6.943	.....	6.799	.....	26.421	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON IN PITTSBURG

Month	Bessemer		Basic		No. 2 Foundry	
	1912	1913	1912	1913	1912	1913
January	$15.12	$18.15	$13.32	$17.35	$14.00	$18.59
February	15.03	18.15	13.28	17.22	14.01	18.13
March	14.95	18.15	13.66	16.96	14.10	17.53
April	15.13	17.90	13.90	16.71	14.15	16.40
May	15.14	17.68	13.90	15.80	14.12	15.40
June	15.15	.....	14.11	.....	14.22	.....
July	15.15	.....	14.38	.....	14.38	.....
August	15.43	.....	14.90	.....	14.85	.....
September	16.86	.....	16.03	.....	15.63	.....
October	17.90	.....	17.18	.....	17.22	.....
November	18.07	.....	17.09	.....	18.00	.....
December	18.15	.....	17.45	.....	18.73	.....
Year	$16.01	.....	$14.93	.....	$15.28	.....

STOCK QUOTATIONS

COLO. SPRINGS June 24

Name of Comp.	Bid.
Acacia	.02½
Cripple Cr'k Con.	.01¼
C. K. & N.	.12
Doctor Jack Pot.	.06½
Elkton Con.	.52
El Paso	3.20
Findlay	.02
Gold Dollar	.10
Gold Sovereign	.02⅝
Isabella	.10½
Jack Pot	.04½
Jennie Sample	.05½
Lexington	‡.008
Moon Anchor	.0095
Old Gold	.01½
Mary McKinney	.56½
Pharmacist	.01½
Portland	.95
Vindicator	.90½
Work	‡.004

SALT LAKE June 24

Name of Comp.	Bid.
Beck Tunnel	.05½
Black Jack	.08
Cedar Talisman	.01
Colorado Mining	.14
Columbus Con.	‡.07½
Crown Point	.01
Daly-Judge	6.35
Grand Central	.47
Iron Blossom	1.27½
Little Bell	‡.10
Lower Mammoth	.03½
Mason Valley	5.00
May Day	.06
Nevada Hills	.90
New York	.02
Prince Con	.35
Silver King Coal'n	3.30
Sioux Con.	.02½
Uncle Sam	.05½
Yankee	.07

TORONTO June 23

Name of Comp.	Bid	Name of Comp.	Bid
Bailey	.08	Foley O'Brien	.26
Coniagas	7.25	Hollinger	16.00
T. & Hudson Bay	‡67.00	Imperial	‡.03
Timiskaming	.34	Jupiter	.35
Wettlaufer-Lor	.11	Pearl Lake	.31
Apex	‡.01	Porcu. Gold	.11
Crown Chartered	‡.00½	Preston E. D.	.03
Dobie	.25	Rea	.12
Dome	‡15.00	Swastika	.05
Dome Exten	.09	West Dome	.15

SAN FRANCISCO June 24

Name of Comp.	Bid	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.06	Belmont	6.12½
Belcher	.17	Jim Butler	.73
Best & Belcher	.06	MacNamara	.16
Caledonia	1.30	Midway	.40
Challenge Con.	.03	Mont.-Tonopah	1.05
Chollar	.01	North Star	.91
Confidence	.22	West End Con.	1.27½
Con. Virginia	.06	Atlanta	.14
Crown Point	.21	Booth	.02
Gould & Curry	.01	C.O.D. Con.	.04
Hale & Norcross	.09	Comb. Frac.	.03
Mexican	.69	Jumbo Extension	.19
Occidental	.70	Pitts.-Silver Peak	.46
Ophir	.15	Silver Pick	.02
Overman	.59	St. Ives	‡.30
Potosi	.01	Tramp Con.	.01
Savage	.06	Argonaut	‡1.60
Sierra Nevada	.06	Bunker Hill	‡1.90
Union Con.	.08	Central Eureka	.12
Yellow Jacket	.22	So. Eureka	‡2.75

N. Y. EXCH. June 24

Name of Comp.	Clg.
Amalgamated	65⅛
Am. Agri. Chem.	45
Am. Sm. & Ref., com	62¼
Am. Sm. & Ref., pf.	99
Am. Sm. Sec., pf. B	79⅝
Anaconda	33⅜
Batopilas Min.	1
Bethlehem Steel pf	67
Chino	34⅝
Federal M. & S., pf.	33½
Great Nor., ore. ctf.	33½
Guggen. Exp.	42¼
Homestake	101
Inspiration Con.	15
Miami Copper	21⅛
Nat'nal Lead, com.	45½
National Lead, pf.	105½
Nev. Consol.	14¼
Phelps Dodge	195
Pittsburg Coal, pf.	76
Quicksilver, pf.	6
Ray Con.	16⅞
Republic I. & S. com.	19⅛
Republic I. & S. pf.	75½
Sloss-Sheffi'd, com.	24
Sloss Sheffield, pf.	85
Tennessee Copper	30
Utah Copper	42½
U. S. Steel, com.	53¼
U. S. Steel, pf.	103¾
Va.-Car. Chem., pf.	95¼

N. Y. CURB June 24

Name of Comp.	Clg.
Barnes King	1.28
Beaver Con.	.34
Big Four	.47
Braden Copper	6¼
B. C. Copper	2¼
Buffalo Mines	2¼
Can. G. & S.	.23
Con. Ariz. Sm.	5/16
Davis-Daly	1⅞
Diam'field-Daisy	.03
Ely Con.	.07
Florence	.35
Giroux	1½
Gold Hill Con.	‡¼
Goldfield Con.	1 13/16
Greene Cananea	6
Greenwater	.05
Internat. S. & R.	‡109
Kerr Lake	3⅛
Keystone	‡2
La Rose	2⅜
McKinley-Dar-Sa.	1⅝
Min. Co. of A. new	2½
Motherlode Gold.	‡.60
Nipissing Mines	9
Ohio Copper	11/16
Pacific Sm. & M.	1/16
Puebla S. & R.	2
South Live Oak	‡2
South Utah M. & S.	¼
Stand'd Oil of N.J.	343
Stewart	1½
Tonopah	4⅞
Tonopah Ex.	2
Tonopah Merger	.68
Tri-Bullion	¼
Tularosa	5/16
Union Mines	5/16
United Cop., pfd.	‡3
Yukon Gold	2¼

LONDON June 14

Name of Com.	Clg.
Camp Bird	£0 17s 9d
El Oro	0 15 0
Esperanza	0 18 1½
Mexico Mines	5 15 0
Oroville	0 5 6
Santa Gert'dis	1 5 0
Stratton's	0 1 9
Tomboy	1 7 6

BOSTON EXCH. June 24

Name of Comp.	Clg.
Adventure	1⅛
Ahmeek	275
Alaska Gold M.	9⅝
Algomah	1⅛
Allouez	30½
Am. Zinc	19
Ariz. Com., ctfs.	3
Bonanza	.30
Boston & Corbin	.55
Butte & Balak	1 5/16
Calumet & Ariz.	60
Calumet & Hecla	410
Centennial	10½
Cliff	1½
Copper Range	39½
Daly West	2⅛
East Butte	10⅛
Franklin	5¼
Granby	54
Hancock	15¼
Hedley Gold	30
Helvetia	.40
Indiana	5
Island Cr'k, com.	47½
Island Cr'k, pfd.	82½
Isle Royale	18¾
Keweenaw	1¾
Lake	6¾
La Salle	3½
Mass	2½
Michigan	.95
Mohawk	45
New Arcadian	.90
New Idria Quick	‡17⅝
North Butte	25
North Lake	1½
Ojibway	.60
Old Dominion	42
Osceola	78
Quincy	57
Shannon	7⅜
Shattuck-Ariz.	23
Superior	23½
Superior & Bost.	2¼
Tamarack	22
Trinity	3¼
Tuolumne	2
U. S. Smelting	36
U. S. Smelt'g, pf.	47
Utah Apex	1½
Utah Con.	7½
Victoria	.95
Winona	1¼
Wolverine	44½
Wyandot	¾

BOSTON CURB June 24

Name of Comp.	Bid
Bingham Mines	3
Boston Ely	.40
Boswycocolo	‡.01
Butte Central	.15
Cactus	.03
Calaveras	2½
Chief Cons	1 5/16
Corbin	.80
Cortez	.30
Crown Reserve	3½
Eagle & Blue Bell	⅜
First Nat. Cop.	1⅜
Houghton Copper	1½
Majestic	.34
Mexican Metals	.36
Moneta Porc.	‡.06
Nevada-Douglas	1½
New Baltic	.70
Oneco	.70
Raven Copper	.02
Rhode Island Coal	.02
Smokey Dev.	½
S. W. Miami	2
South Lake	4½
Trethewey	.33
United Verde Ext.	.66

‡Last quotation.

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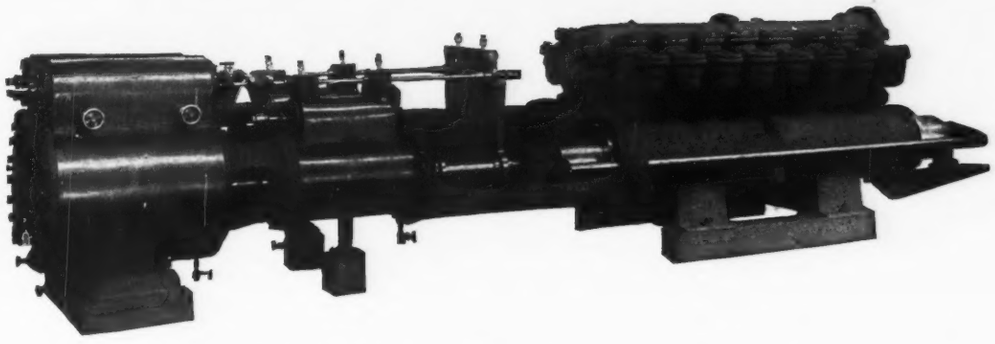

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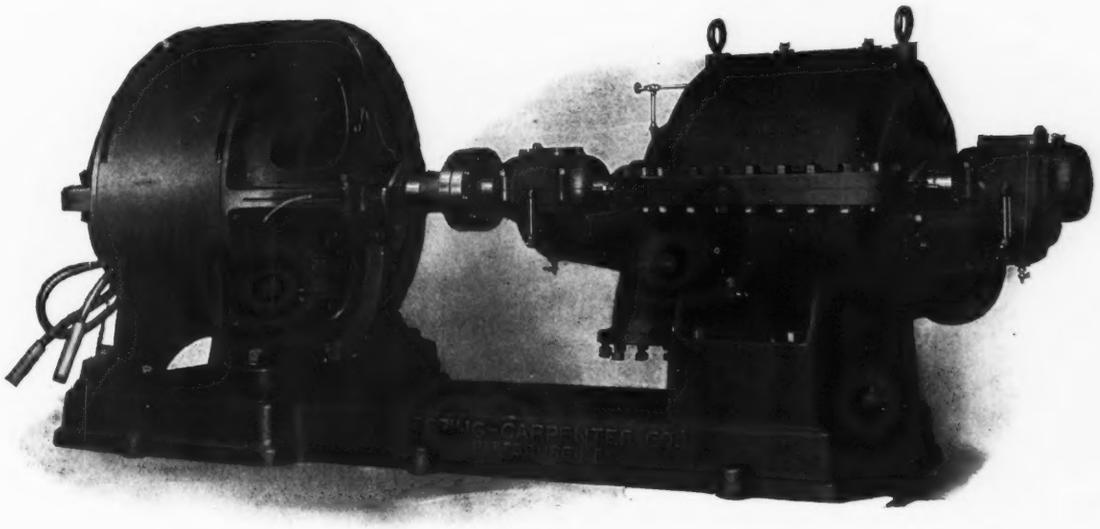

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CONVEYING S-A MFG. CO. ENGINEERS TRADE MARK

Weekly News Of Notable Cost-Cutting Equipment

CONVEYING S-A MFG. CO. ENGINEERS TRADE MARK

With an Automatic Feeder is More Economical than Without

"S-A" Apron Feeder—

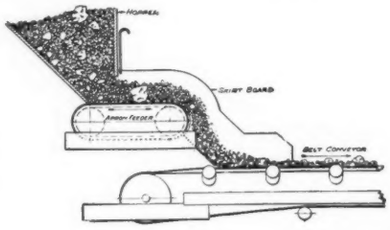
EVERY crusher and conveyor the country over must be fed uniformly if maximum efficiency is to be reached.

Where lump material is delivered from a bin it is only possible to obtain an even flow with the use of an automatic feeder. In this case it's a waste of money not to use one.

An uneven flow of ore from a bin opening demands the use of a crusher or conveyor of sufficient capacity to equal the maximum flow, but which must usually operate below capacity. An automatic feeder regulates the flow so that a small crusher or conveyor may be used, consuming less power and operating at full capacity all of the time—there's true economy.

A feeder of the heavy type—large capacity. It is capable of handling huge lumps of ore more than a foot in diameter and yet maintains a perfect, steady feed for the finer ore. This feeder is used below ore bins and hoppers all over the country. See its compactness—its evident advantages.

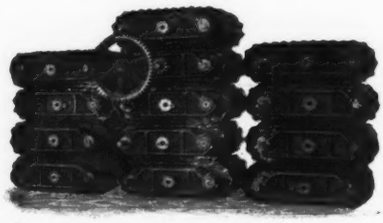
The load acts entirely upon the steel apron and the slow steady travel of the apron requires little power, produces no vibration and requires practically no attention. The life of an "S-A" Apron Feeder is practically unlimited—it means economy in the fullest sense of the word.



If you are not positive just what type of feeder will be best for you, just put the problem up to our engineering experts, maintained for that very purpose. **Get their opinion, anyway. Just write.**

Thirteen Cost Cutters

"S-A" Apron Feeders



photographed just before they left our shops to go on the job for more and better economy at the plant of the Butte and Superior Copper Company. These feeders were each three feet two inches centers, with 30-inch aprons, designed to operate below 24-inch x 12 inch openings.

"S-A" Automatic Roll Feeders

Built for smaller capacities and for handling smaller lumps, yet made with the same care in the details as the larger types—the same accuracy in adjustment and fittings. Because of its extreme accuracy it is widely used as a proportioning feeder.

The "Labor Saver"—Free

The "Labor Saver" is distinctly a treatise on the modern way of handling conveyor problems. Tells you how your neighbors are handling theirs. This great little publication is free. Getting on the mailing list won't obligate you, so do it before you're an hour older. NOW.

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*REPAIRING A 12-IN. SHAFT WITHOUT REMOVING: *Page* 1281

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CIRCULATION OF THIS ISSUE 10,000

None sent free regularly, no returns from news companies, no back numbers

Moments With The Ad. Manager

The Business Page

A very curious case came to our attention the other day. It was so unusual that we believe you, too, will be greatly interested in it.

A few years ago *Rubifoam* was a national tooth wash. Our sisters, our cousins and our aunts used it. It was sold practically all over the country. And the girl with the *Rubifoam* smile was as well known as—well, say as well known as a Vice-Presidential nominee before his election.

But suddenly this girl disappeared. Her dazzling smile no longer lighted up magazine pages, glorified billboards, burst forth from newspapers. *Rubifoam* was no longer advertised.

A coterie of advertising men got together and decided to go after the manufacturer of *Rubifoam* and find out the why and wherefore of Miss Rubifoam's retirement.

This manufacturer lived up in New England.

"What's the matter—lost your nerve; didn't the advertising pay you?" asked the advertising men when at last they confronted the manufacturer.

He shook his head, smiled. "Yes, it paid me. I believe in it—thoroughly."

Naturally his questioners were dumbfounded. "Well, what—!"

"You see, gentlemen, it's this way. I've built up this business entirely by myself. I have no one to whom to leave it. I have no idea how it would be managed after my death—no idea as to whether the standard of the product would be kept up. I want to guard against its deterioration. So I've simply let the advertising drop and the business is slowly dying. I figure by the time I'm ready to pass in my checks the business will be about finished, too."

The advertising men, when they had sufficiently recovered from their astonishment, told him it was his duty to the community to continue advertising, that he was throwing his employees out of work and tried a host of similar arguments. But the manufacturer refused to give up his peculiar views regarding the matter.

It would cause an earthquake like a hundred panics combined if all advertisers should suddenly make a decision similar to this which the manufacturer of *Rubifoam* made.

Imagine the quandary you'd be in. Where would you buy the things that are absolutely essential to you?

There was a time when man was almost entirely independent of other men.

He tilled his own ground (or rather his wife did), raised the vegetables and fruits he needed and killed the meat and clothed himself with the skins of the animals he killed.

But year after year, century after century, that kind of independence has slowly gone. Modern man is dependent upon his fellow men.

Like a huge net this dependence of ours upon each other stretches through the fabric of life.

Today we look to others for the bed we lie in, the house we live in, the clothes we wear, even the food we eat. Others look to us for that one small thing which is our product.

New York City, shut off from its food supplies, would have a starving population within 48 hours.

Advertising is the means by which men offer their product to as many other men as possible—hundreds of men, thousands of men where before they could only reach individuals.

Advertising enables men who manufacture the machinery you use to come direct to you with their product no matter where you are.

The advertisers, of course, depend upon you but you also depend upon the advertisers.

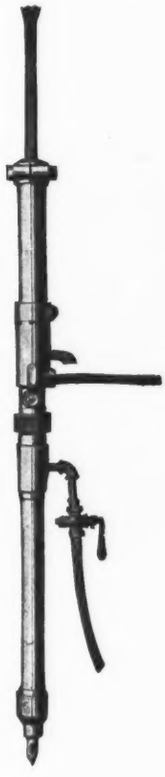
Think about it as you read over the Selling Section this week.

It's A General Utility Drill

The Cleveland "Little Miner"

No one is a firmer believer in each type of drill for a certain definite purpose than we are. But very often in a small mine or a large one, for that matter, there's an urgent need for a light drill that can be turned to almost any work, and do it well. Such is the Cleveland "Little Miner." It's a jack of all trades.

Stoping — Sinking — Drifting



Stoping:—The "Little Miner" can be very efficiently used in either soft or medium ground. In many mines these machines are in service for removing roof where the height of the drift is to be increased, for putting pop holes in boulders in the ore chute, which are too big and must be broken up for surveyor's holes, etc.

Sinking:—By simply giving a knurled sleeve a half turn the air feed locks to the cylinder and becomes inoperative. The operator lays the feed cylinder against his shoulder and can turn the cylinder back and forth by means of the rocker handle. In this way pop holes may be put in boulders too big to be loaded on a car without first being broken up, holes put in a tunnel floor should it be necessary to lower it—in fact the "Little Miner" can be relied on to do everything a hand sinker will do and yet you have the advantage of other possibilities, which a hand sinker does not possess.

Drifting:—We make a light single screw column easily handled and set up by one man, and with the "Little Miner" so mounted we have an ideal machine for the prospector, coal mine, or for any big property because the column comes in handy enough times to make it soon pay for itself.

Get particulars about the "Little Miner." Find out how well you can use him at your mine. Just drop us a postal for full details.

Send for Catalog No. 8 for full particulars. There is a size and type of Cleveland Drill for every requirement.

"POP" HOLING WITH A CLEVELAND "LITTLE MINER"

Note the Air Feed Locked Cylinder

The Cleveland Rock Drill Company

6410 Hawthorne Avenue, Cleveland, Ohio

New York, 30 Church Street

San Francisco, Calif.—D. D. Demarest Co.
Los Angeles, Calif.—Smith-Booth-Usher Co.
Mexico City, Mexico—United Sales Co.

Chicago, 704 Fisher Building

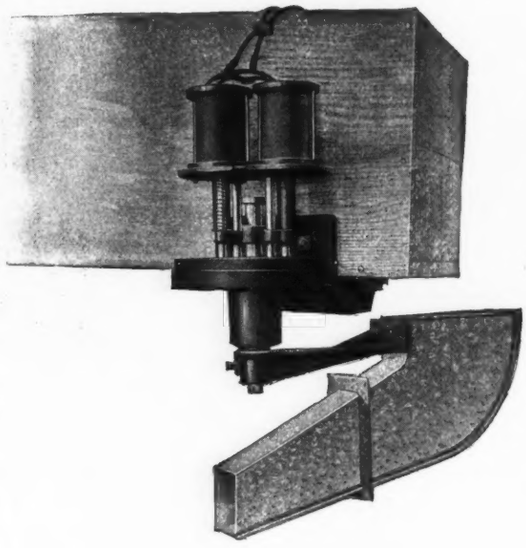
Denver, Colo.—Vaughan Machinery Co.
Salt Lake City, Utah—Salt Lake Hardware Co.
Wallace, Idaho—Coeur d'Alene Hardware Co.

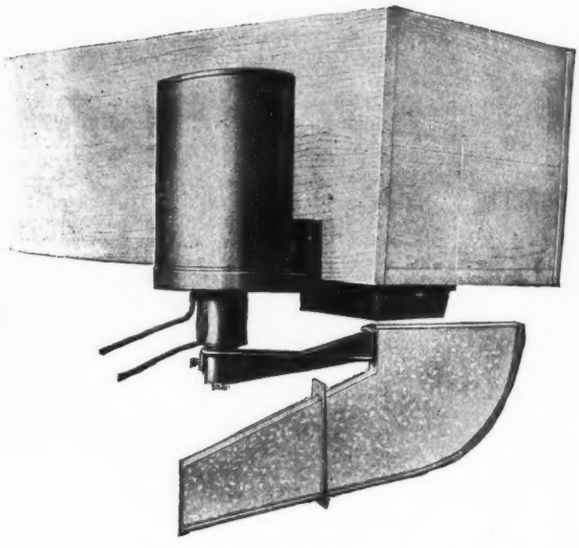
Victor, Colo, Geo. M. Harris.
Ishpeming, Mich.—P. O. Box No. 234
Butte, Mont., Western Mining Supply Co.
The names of Foreign Agents in any locality supplied on request.

Canadian Trade supplied by Cleveland Pneumatic Tool Co., of Canada, Ltd., 80 Duchess Street, Toronto, Ont.

Are You Losing Money in Your Mill?

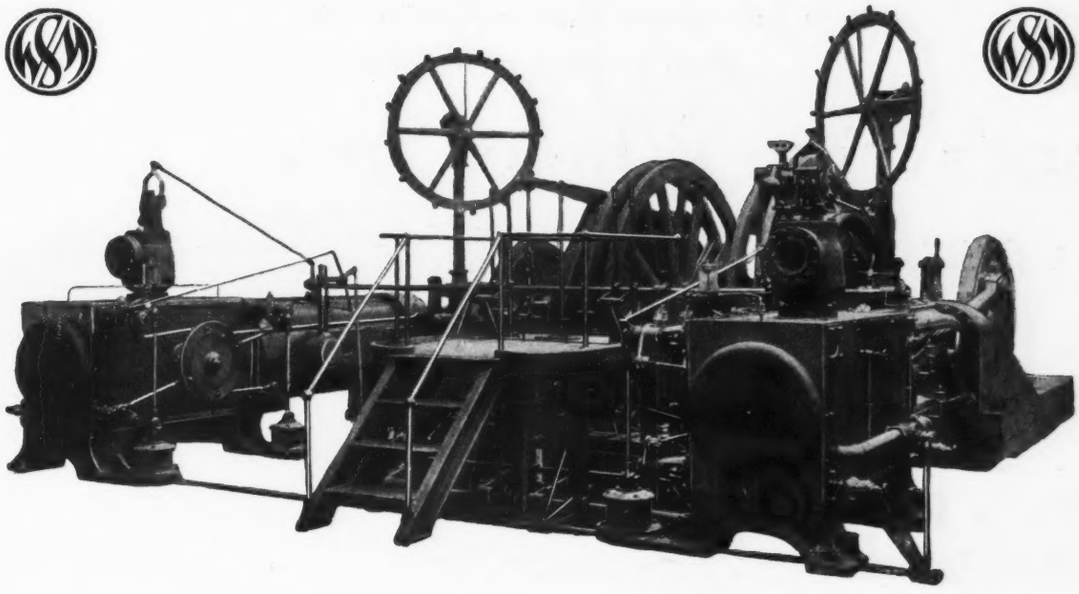
Find out where the losses are, and perhaps a small change will save all you are now losing. You should take samples at regular intervals at various points. This can be done with a *Flood Sampler*





Automatic, Simple, Accurate. No trouble to install
Little headroom required. No attention required to operate

The Hendrie & Bolthoff Mfg. & Supply Co.
Denver Colorado



More and More Steel

is being used right along

In Mine Hoists

The W. S. M. Hoist above

was built to meet special conditions—hoisting from great depths with short leads.

It provides for **flat** rope wound on reels making the short leads possible and giving better balance between upcoming and downgoing cages.

Greater depths, higher speed, and heavier loads have necessitated stronger hoists for mine use. And the practical solution has been found in the substitution of steel parts in many instances in which iron has been formerly used—as for instance, gears and drums

In this connection, note this:—

Wellman-Seaver-Morgan Hoists

are always made with steel parts when occasion demands. We never dodge the issue. For we have our own steel foundries and have no difficulty in turning out even the largest and most intricate steel castings.

Before you decide on a hoist, consult our Engineering Department. It will put you under no obligations—it MAY have important results.

The Wellman-Seaver-Morgan Company

Engineers and Manufacturers

GENERAL OFFICES: CLEVELAND, OHIO, U. S. A.

BRANCH OFFICES:

NEW YORK Hudson Terminal. DENVER, 611 Ideal Building. MEXICO, D. F., Apartado 1220—14 a de Guerrero 3326

A man does his best work when he does the amount of work that's best for him.

That's the Whole Secret of the Success of "Scientific Shoveling"

WYOMING
"21 POUND LOAD"
SHOVELS
(*Registered Trademark*)

That's the whole basis of the efficiency shovel load—21 pounds—the average load at which he does his best day's work all day long.

That's the reason why a shoveler does more work with less effort.

Because each time he takes naturally an approximate load on his shovel of 21 pounds.

He does more work simply because he is working under the right conditions.

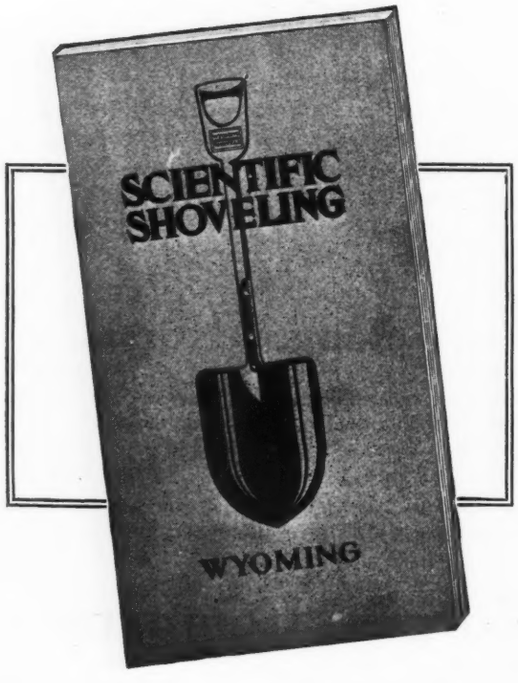
That is why a Wyoming 21-Pound-Load Shovel is made for any given material handled around your mine—

There is a Wyoming 21-Pound-Load Shovel suitable for lump ore, one for the wet, heavy concentrates, one for tailings, one for dirt, sand, concrete, etc., etc.

Frederick W. Taylor, the efficiency expert, *tripled* his shovelers' capacity—starting with a gang of 600 of them.

You can at least double your shovelers' capacity.

Isn't it worth your investigation?



This is the Book to send for

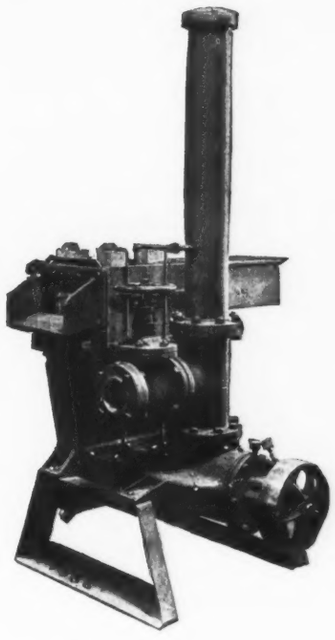
It is an excerpt from Frederick W. Taylor's "The Principles of Scientific Management," reprinted by permission of the publishers, Harper and Bros.

We shall be glad to send you a copy simply for the request. Write us today.

The Wyoming Shovel Works, Wyoming, Pa.

Makers of Good Shovels for almost 40 years.

Increase Your Saving and Your Mill Capacity



through the installation of the RICHARDS PULSATOR JIG.

No, your problem is not as hard to solve as it may seem. Your floors are NOT too weak—and there is plenty of room for the RICHARDS PULSATOR JIG of 40 TONS DAILY CAPACITY—because it can be placed in a space 3 ft. x 3 ft.—weighs only 800 lbs.—wherever you want to place it, YOU CAN. Ask for BULLETIN 1060. It cites the particulars.

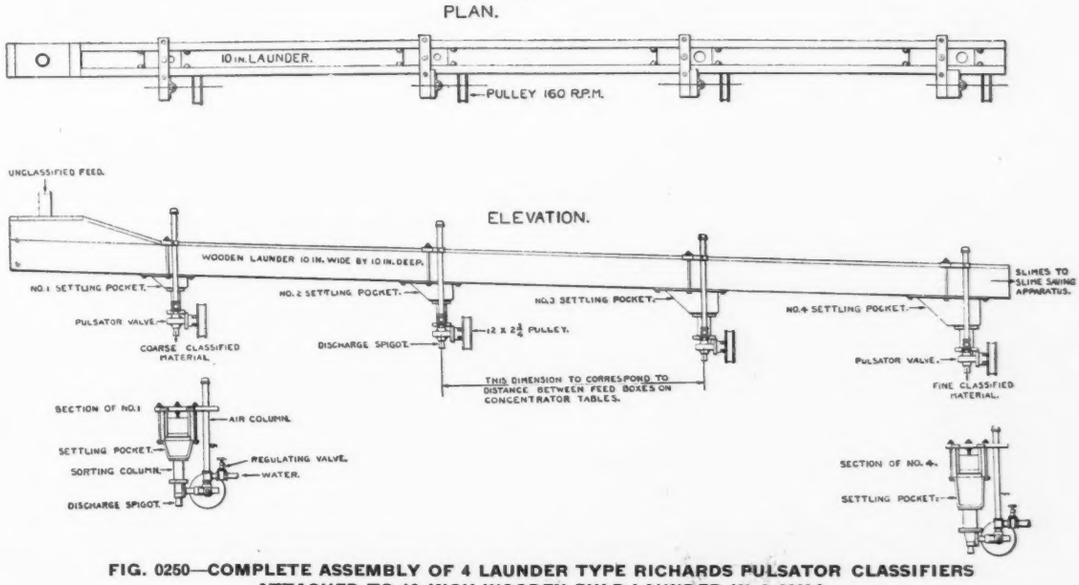


FIG. 0250—COMPLETE ASSEMBLY OF 4 LAUNDER TYPE RICHARDS PULSATOR CLASSIFIERS ATTACHED TO 10-INCH WOODEN PULP LAUNDER IN A MILL

You may reduce this Classifier to as few tables as required—or extend it to any number of tables—on account of its FLEXIBILITY.

MANUFACTURERS!

Electric Hoists
Richards Pulsator Jigs
Richards Pulsator Classifiers
Ore Crushers
Crushing Rolls
Mine Cages
Stamp Mills
Tube Mills
Mine Timber Framing Machinery
Revolving Screens and Grizzlies
Automatic Samplers
Sample Grinders
Ore Buckets

The Denver Engineering Works Company

Denver, Colorado, U. S. A.

STANDARD CRUSHER PARTS

How Severe Crushing Conditions Are Met

If you could see "Standard" Crusher Parts being made you would understand why they stand up to unusually severe crushing demands.

If you could see how particular we are that the raw material comes up to specification—

If you could see raw material converted into ingots of a tested hardness, the ingots forged, punched, hammered and rolled into absolutely weldless Crusher Parts—

If you could see the care and exactness with which all this is done—

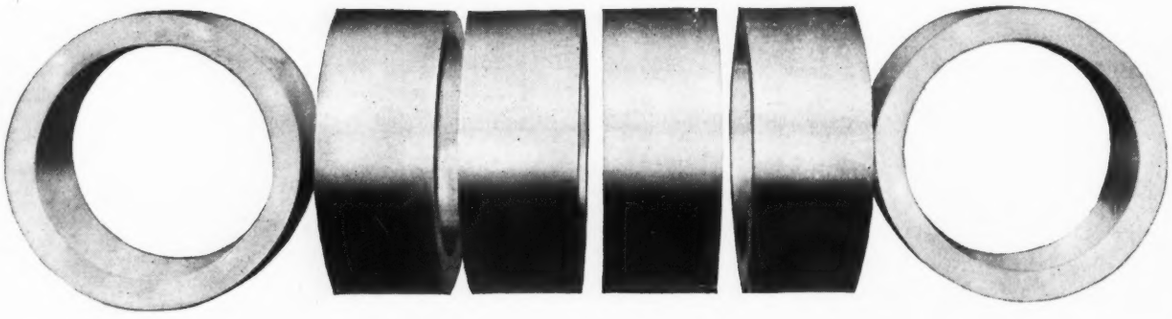
Then you would know why "Standard" Crusher Parts give splendid durability even where conditions are most trying.

Even though you have not seen "Standard" Crusher Parts made there is no reason why you should not profit by their quality.

May we send you a copy of our Catalog?

⚓S⚓ BRAND

The "Standard" Brand on your crusher parts is an assurance of eventual economy.



Standard Steel Works Company

Morris Building, Philadelphia, Pa.

New York, N. Y. Pittsburgh, Pa. Chicago, Ill. St. Louis, Mo. San Francisco, Cal.
Richmond, Va. Portland, Ore. Denver, Colo. City of Mexico, Mex.

Steel Tires, Steel Tired Wheels, Solid Forged and Rolled Steel Wheels, Rolled Steel Gear Blanks, Steel and Iron Axles, Steel and Iron Forgings, Steel and Iron Castings, Rolled Steel Rings, Steel Crusher Rolls and Shells, Steel Pipe Flanges.

—WHAT-ARE-YOU-USING—

?

OIL LAMPS-CANDLES-BALDWINS

If you are still using oil lamps or candles, go through your mine, count the number in use, multiply this number by the figure 7 and the total will show you in dollars how much money you are wasting each year.

Every oil lamp which you are using is costing you $7.00 more per year for oil, wicks, etc., than it is costing others who are using Baldwin lamps for carbide, and carbide is practically your only expense when you are using Baldwin lamps.

Had you started using Baldwin lamps a year ago, your records would show a big decrease for your year's lighting expense. Whether you use a few lamps or a thousand, every Baldwin lamp will save several times its initial cost before it wears out.

We admit that the initial cost of a Baldwin is somewhat higher than the cost of an oil lamp, as well as that all you pay for a Baldwin is gone when the lamp is worn out, but a Baldwin will last at least 6 months, and the saving in operating expense (fully $7.00 per year) is so great that no superintendent who gives any thought to the matter of efficient management can afford to go on using oil lamps, and as for candles, it has long been admitted that they are even more expensive than oil.

Let Us Prove This Before You Invest A Penny

We are willing to bear the expense. It shall not cost you a cent for lamps until you are satisfied. Use the coupon attached, let us send you a trial lamp, use it for a month, keep a record of the operating expense, compare this with the cost of oil; this comparison will tell the complete story. Will you do this for the sake of economy?

JOHN SIMMONS COMPANY,

102 Centre Street, New York

Branches: { **268-A Market St., San Francisco, Cal.**
56 St. Nicholas St., Montreal, Can.

JOHN SIMMONS COMPANY, 102 CENTRE STREET, NEW YORK
Baldwin Lamps are not used in our mines. I will thoroughly test a lamp if sent **FREE OF CHARGE**

I am superintendent of .....
Name of mine and company .....
No. of men employed underground .....
Signed .....
Address .....
We usually buy our supply of lamps, etc. .....
From .....

189

"The Handiest Rig I Ever Got Hold Of"

Said The Mine Foreman

"For pulling timber up into stopes or hoisting muck from a winze"—

So wrote M. H. McLean, Foreman—The Detroit Copper Mining Company of Arizona.

And thus added another name to the big list of users endorsing the

HOLMAN
Stretcher-Bar Hoist

A powerful, and yet light and portable hoist capable of taking the place of your ponderous 1200 to 3000 lb. hoists, and usable in hard-to-get-at places heretofore unapproachable by *any* kind of a hoist.

Wherever there is room for your men there is plenty of room for a Holman Stretcher Bar Hoist—requires no foundation, and it's not necessary to cut out any room or station to install it.

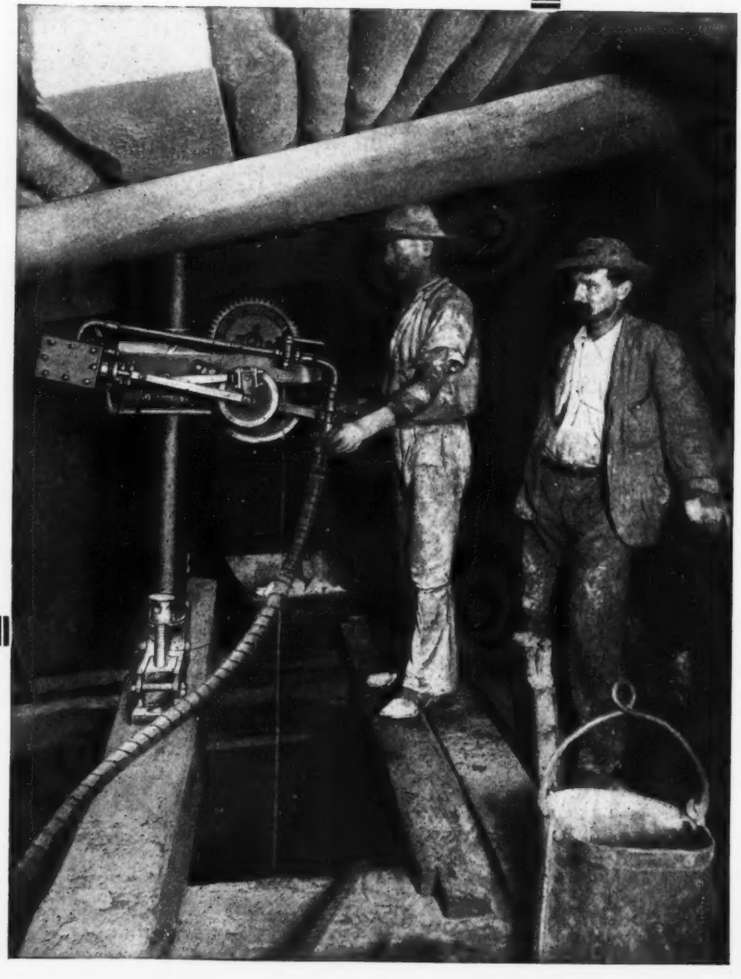
With this hoist you can lift from 500 to 1000 lbs. with ease—*any* laborer can operate it and can do in a few minutes what would ordinarily take 3 or 4 men hours to do. Operated with air or steam, and *rarely*, if ever, requires any attention or repairs.

You ought to investigate this—ought to do t *now*.

Write to the nearest office for full particulars, catalog, etc.

Ask for Bulletin No. 27.

These hoists are carried in stock in all our branch stores, and also by The Mining Machinery Co., Seattle, Wash., and The W. F. Bohne Machinery Co., Joplin, Mo.



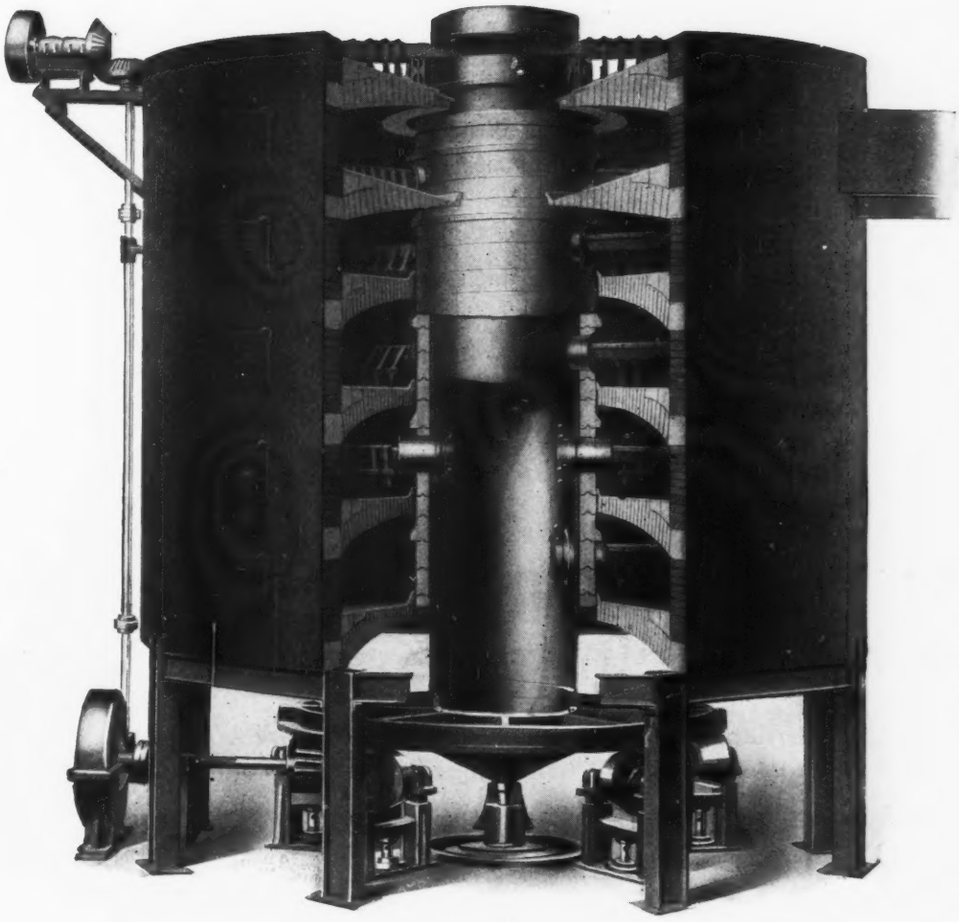
The Mine & Smelter Supply Co.

Denver **Salt Lake City**
El Paso **Mexico City**

N. Y. Office, 42 Broadway

The Wedge Mechanical Furnace

(Patented)



High Temperatures

The above roasting furnace will stand high temperatures without encountering mechanical difficulties, and can be fired with oil, gas or coal, as desired.

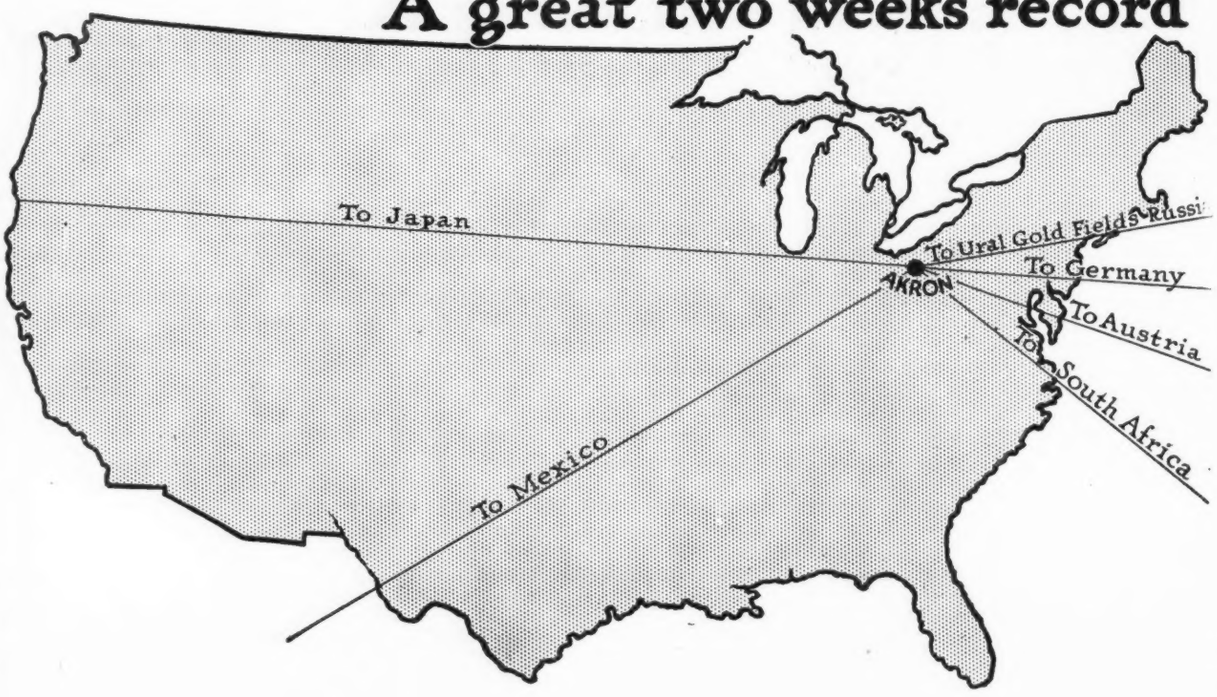
Notice the shaft is insulated with fire brick, and no air or water is required to cool the central shaft as is the case where cast iron shafts are used.

Write us stating analysis of ore, concentrates, mixture or material you desire to roast, characteristics and physical condition of same, number of tons to be treated per twenty-four hours, and results desired in the calcine.

Wedge Mechanical Furnace Company

Philadelphia, Pa.

A great two weeks record



Proof extraordinary that Goodrich Conveyor Belts give longest service

Orders in rapidly increasing volume are coming to us for belts to be shipped to foreign countries.

LONGLIFE CONVEYOR BELT

has been shipped to Canada, Newfoundland, Mexico, Panama Canal, Colombia, Chile, Argentine Republic, England, France, Belgium, Germany, Austria, Russia, Sweden, South Africa and Australia.

This increasing use of "Longlife" in the face of strenuous competition, is forceful proof of the superior service given by the belts of Goodrich make.

Just look at this two weeks' record

During the first two weeks of March ten orders were received for Germany and Austria, a big dredge belt was ordered for Ural goldfields, Russia; large belts were ordered for Japan and South Africa, while Canada and Mexico also sent good sized orders.

Specify "Longlife" in your next requisition

There's a reason for all these orders from abroad. That reason is the fact that "Longlife" Belts operate right, give continuous service and handle more tons per dollar cost than any other belt.

The B. F. Goodrich Company

Makers of Goodrich Tires and Everything That's Best in Rubber

Factories: Akron, O. **Branches in All Principal Cities**

There is nothing in Goodrich Advertising that isn't in Goodrich Goods

The Accuracy of the CALYX CORE DRILL

Since any core drill is useful only as a source of information, the first test of its worth is the accuracy of the information it furnishes.

The "Calyx" Drill meets the most rigorous demands on this question of accuracy.

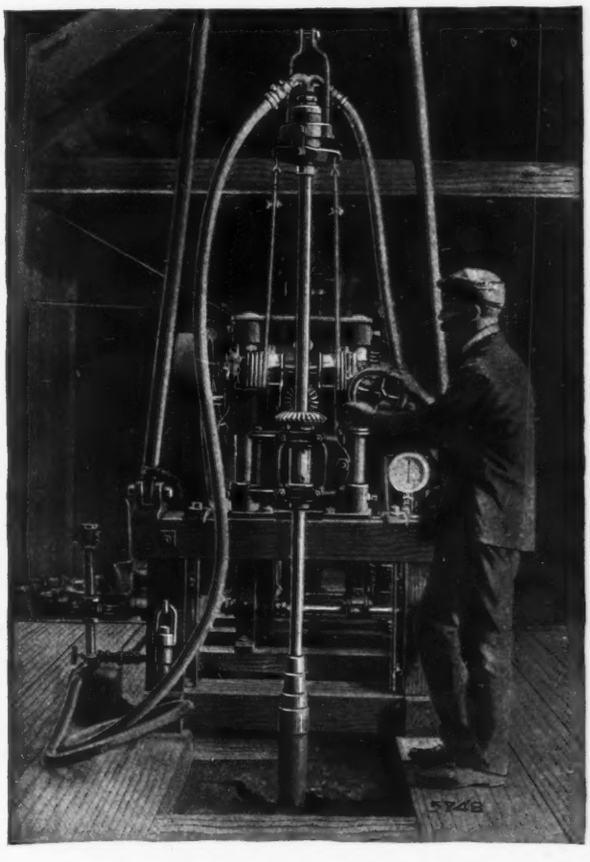
It penetrates any material, from softest clay to hardest rock, with a clean hole from which sharp, perfect, sound cores are drawn, showing not only the character but also the thickness of the materials, and the order and angle in which they lay.

There are some materials from which **small** cores cannot be taken because they will not hold together. **Here the large cores of the "Calyx" are a great advantage.**

Yet the cores need be no larger than are absolutely necessary, for **holes of different diameter can be bored with the same "Calyx" Drill without special features.**

With a "Calyx" Drill you can so test your mining property that you will know in advance every step of development and operation, planning ahead on most efficient lines.

Write for Bulletin 9101.

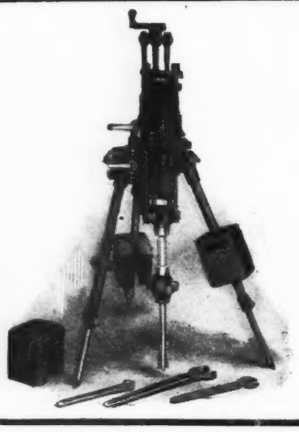


NEW YORK **INGERSOLL-RAND CO.** LONDON

Offices The World Over

Compressors **Rock Drills** **Plug Drills** **Coal Cutters**

CD-3



THE WIZARD ROCK DRILL

with its **Accelerating Piston** and **Corliss Valve** has demonstrated to the satisfaction of Miners, Quarrymen and Contractors, its ability to drill more ground with less cost for power and maintenance than any other piston drill now made.

Make it your duty to investigate the WIZARD before you place your next order.

A descriptive bulletin, with some unbiased opinions from users of **Wizard Rock Drills,** will be sent on request. **Write for it.**

McKiernan-Terry Drill Co.

230 Broadway, New York, N. Y.

CANADIAN REPRESENTATIVES:
Canada Foundry Co. Ltd., Toronto, Ontario

Hammer Drills, Core Drills, Sheet Pile Hammers, Atlas Jacks 1

Diamond Drills

We make the most complete line in the world. Hand Power, Horse Power, Gasolene, Steam, Air, Electricity, Hydraulic Feed, Screw Feed.

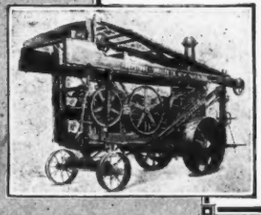
Send f r Catalogue.

STANDARD DIAMOND DRILL CO.

745 First National Bank Bldg., Chicago, U. S. A.

KEYSTONE CABLE DRILLS

for Placer Gold Testing, in advance of dredge; Mineral Prospecting for Lead, Zinc, Coal, Copper, etc.; Oil, Gas, and Water Well Drilling; Blast Holes in Cement and Stone Quarries. Equipped with steam engine, gas or electric motors. In writing specify class of work you are interested in.



KEYSTONE TEST DRILL CO.
BEAVER FALLS, PA.

Electric Hoists Bulletin No. 90132 **Ventilating Equipments Bulletin No. 23532**

At Least 3 Times the Life

Of Ordinary Hose.

That is what Contractors Report

with

Sprague Armored STEAM HOSE

RESULTS TALK

Descriptive Pamphlet No. 51632 sent on request.

SPRAGUE ELECTRIC WORKS

Of General Electric Company

Main Office: 527-531 West 34th St., New York, N. Y.

Chicago Philadelphia Boston Baltimore Pittsburgh
Atlanta San Francisco St. Louis Milwaukee Seattle

WELL DRILLING MACHINES

Over 70 sizes and styles, for drilling either deep or shallow wells in any kind of soil or rock. Mounted on wheels or on sills. With engines or horse powers. Strong, simple and durable. Any mechanic can operate them easily. Send for catalog.

WILLIAMS BROS., ITHACA, N. Y.

Need A Diamond Drill Now—Quick?

We can give it to you—because we know that it is often as important to the man in the field to get a drill **quickly,** as to get a **good** drill and so we have equipped ourselves to meet **both** needs. LONGYEAR DIAMOND DRILLS are made in all sizes and all types. **Write cr Wire.**

E. J. LONGYEAR COMPANY, Minneapolis, Minn.
Manufacturing Plant, Marquette, Mich.

GOLD DREDGES

Extensive Alaska and California Experience.
Send for our descriptive catalog.

UNION CONSTRUCTION CO.

H. G. PEAKE 604 Mission St., San Francisco, Cal. W. W. JOHNSON

¶ Placer Gold, Suction and Dipper Dredges, Excavating Machinery, Centrifugal Pumps, Western Representatives of the Bucyrus Company for Dredging Machinery and General Steel Castings.

THE YUBA CONSTRUCTION CO., Marysville, California

OFFICES:
Works—Marysville, Cal. San Francisco—311 California St.
Seattle, Wash.—Colman Bldg.

Do You Know The Difference

Between merely "drilling" placer ground, and "testing" placer ground? It is the difference between success and failure.

The

"EMPIRE"

Prospecting Drill

Does more than drill holes. It gives test figures that can be relied upon.

New York Engineering Co.

2 Rector Street New York

"EMPIRE" GOLD DREDGES

HERE is a new explosive. ¶It is practically fumeless. ¶It is not necessary to thaw it. ¶Its action is such, that when properly used and the right grade selected for the work to be done, it will bring down the coal in exactly the condition desired. ¶It is safe to handle. ¶Red H was produced after years of experiment and is the best explosive on the market, adapted in every way to all kinds of coal mining except very wet work.

HERCULES

RED H.

A PERFECT PERMISSIBLE POWDER

In wet mines we recommend

XPDITE

All the different grades of Xpdite can be used in comparatively wet work and do not give off harmful fumes on detonation. Both Red H and Xpdite are safe explosives to use in gaseous and dusty coal mines. Write us or one of our Branch Offices for particulars and technical advice.

HERCULES POWDER CO.

Wilmington, Delaware, U. S. A.

BRANCH OFFICES:

Hazleton, Pa. Pittsburgh, Pa. Chicago, Ill. Pittsburg, Kansas San Francisco, Cal. Salt Lake City, Utah.

THE ENTERING WEDGE TO PROFITABLE DRILLING

Improved Wood Rock Drills

Drilling with Wood Drills is profitable for two reasons:

1st. They can be SAFELY run much faster than an ordinary drill, and

2nd. Owing to the strength of the individual parts, the cost of maintenance is reduced to the minimum.

It works two ways; you get more work and you pay less for it, and the reason is, that the Wood Drill is an entirely *practical* tool, produced by twenty years' experience in designing and building rock drills. It has won the confidence of the engineering fraternity in all parts of the world, and is today admitted to be the drill without a peer under any and all conditions.

Write for catalog giving full details.

Western Machinery & Mfg. Co.

1443 Blake St., Denver, Colo.

SALES AGENTS.
Wood Drill Works, Paterson, N. J.
The Scandinavia Belting Co., 125 White St., N Y. City

Please send copy of latest Catalog of Wood Rock Drills

Name .....

Address .....

E & M J

8213

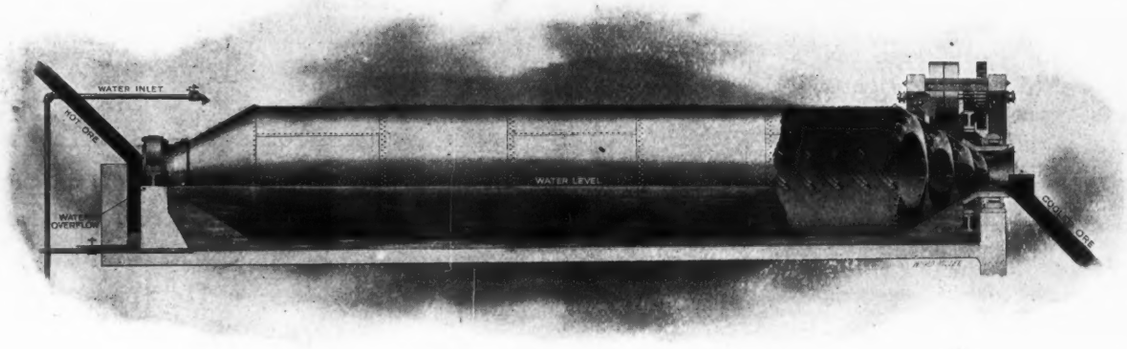
EPITAPH

"Sacred to the memory of the Chilian mill species. Departed this life about 1912, being exterminated by the Hardinge Mill. Requiescat in pace."

The above EPITAPH to the Chilian Mill was written (unsolicited) by the Superintendent of a large Copper Concentrating Company which two years ago discontinued the use of Chilian Mills in favor of the Hardinge Mill, and this Epitaph was in response to an effort to have him dispose of one of their former unused 50,000-lb. Chili Mills, which the Hardinge Co. took in trade for a 13,000-lb. Hardinge Mill. His facetious ridicule following his several unsuccessful efforts to dispose of the Chili Mill, can be construed as good advice to his brother Metallurgists. The Chili Mill is still for sale at half its original cost.

Hardinge Conical Mill Co.
50 Church St. New York

THE BAKER COOLER



"IT FLOATS"

For COOLING ROASTED ORE, CEMENT CLINKER, ETC.

To permit of immersion in solutions or handling on conveyor belts.

THE STEARNS-ROGER Mfg. CO., Denver, Colo.

SOLE AGENTS AND MANUFACTURERS

1860

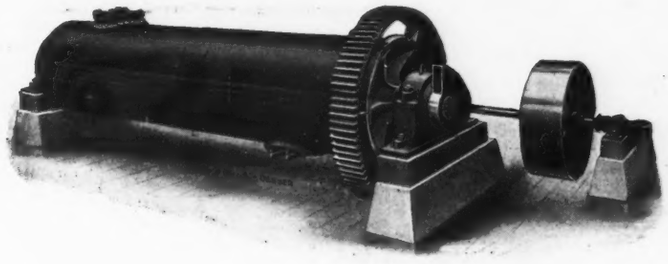
COLORADO IRON WORKS COMPANY

ORE SMELTING EQUIPMENTS

ORE MILLING MACHINERY

1913

Tube Mills



All preferred sizes. Substantial, well designed, of best material and workmanship. We aim to furnish tube mills, which once installed, give no further trouble.

Colorado Iron Works Company, Denver, Colorado, U. S. A.

Half tone illustrates one of the designs of

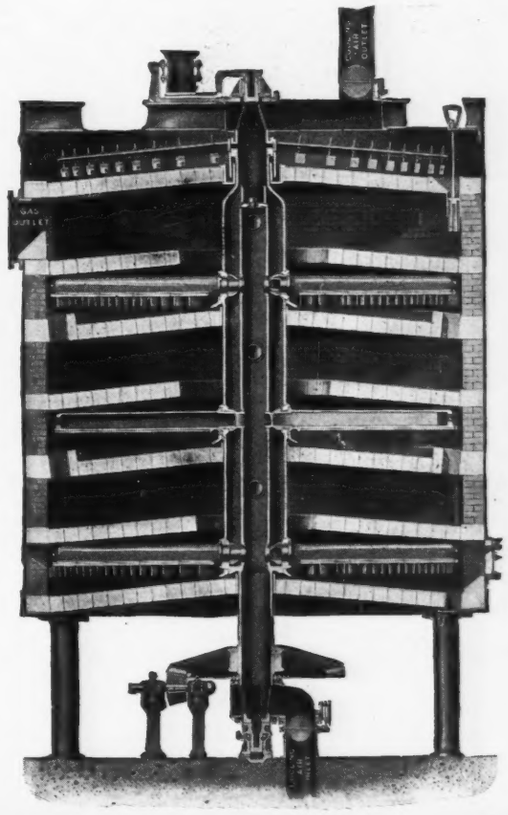
New Herreshoff Pressure Air Cooled Roasting Furnace

(Patented)

for Metallurgical work; equipped with our patented top Dry Feed. Shaft and arms cooled by air blown from a fan into inner shaft, then through the arms and is discharged between the inner and outer shaft.

By proper control of temperature of the roasting ore and practical utilization of heat, ores of lower percentage of sulphur than heretofore thought possible, are roasted without the use of fuel.

Furnaces of any size. Special designs to suit particular conditions. Send for Bulletin.



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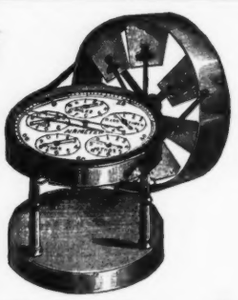

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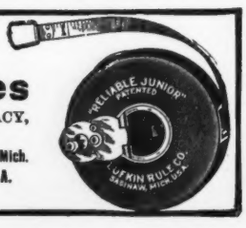

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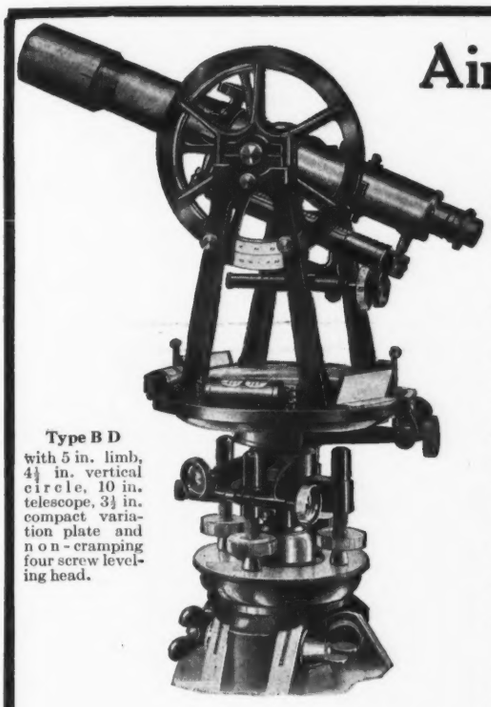

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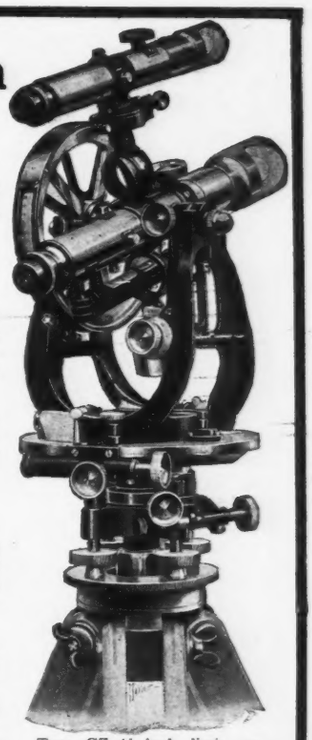

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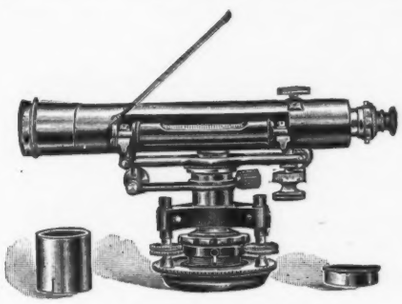

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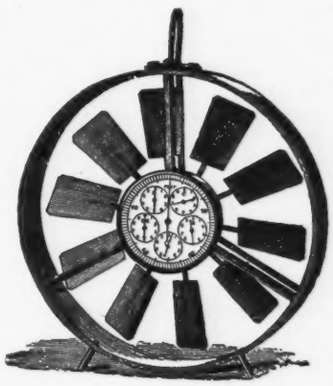

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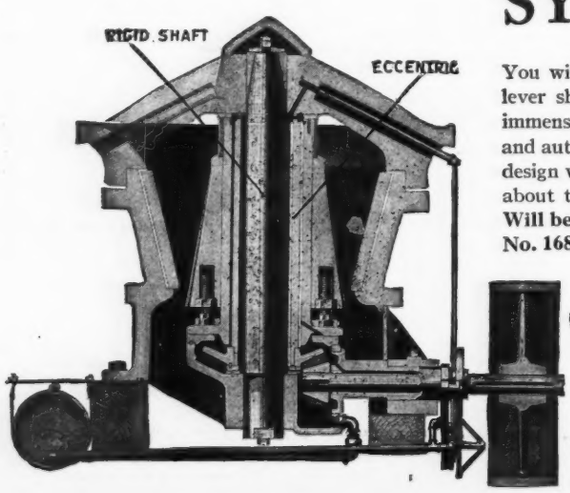

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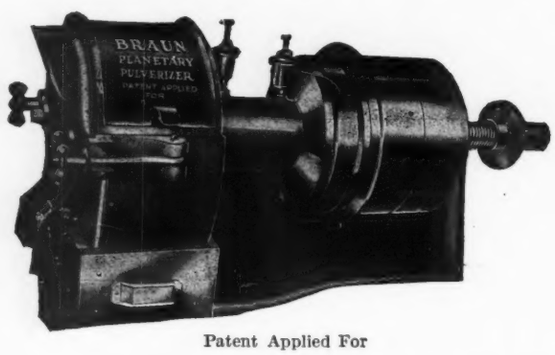

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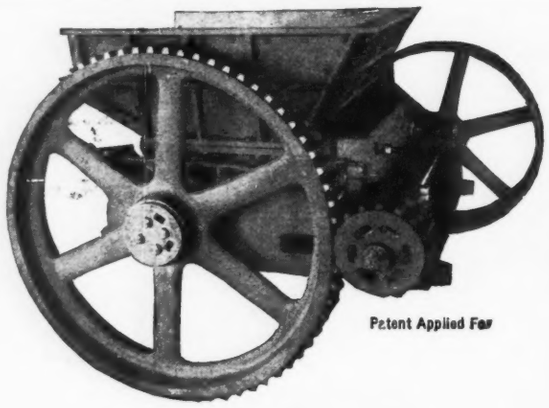

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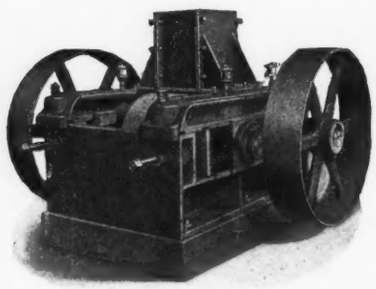

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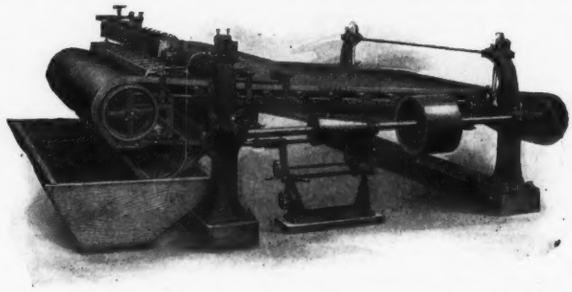

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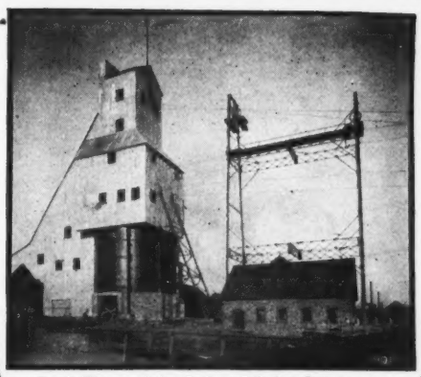

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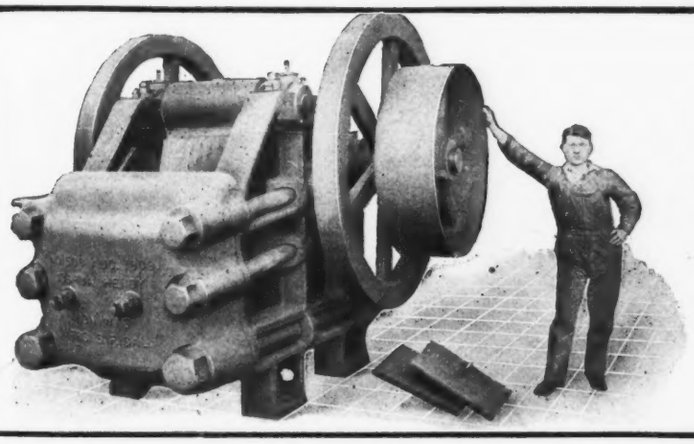

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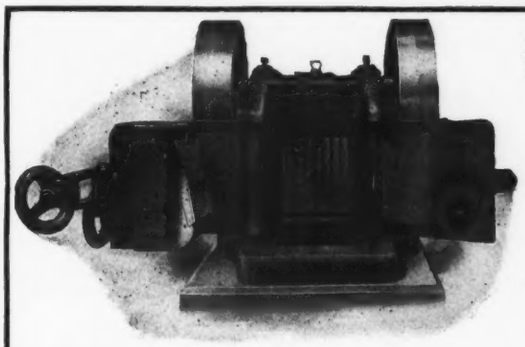

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All Have "Open Door" Accessible Construction.

Heavier, Better Built, More Accurate, Easier Cleaned than any others.

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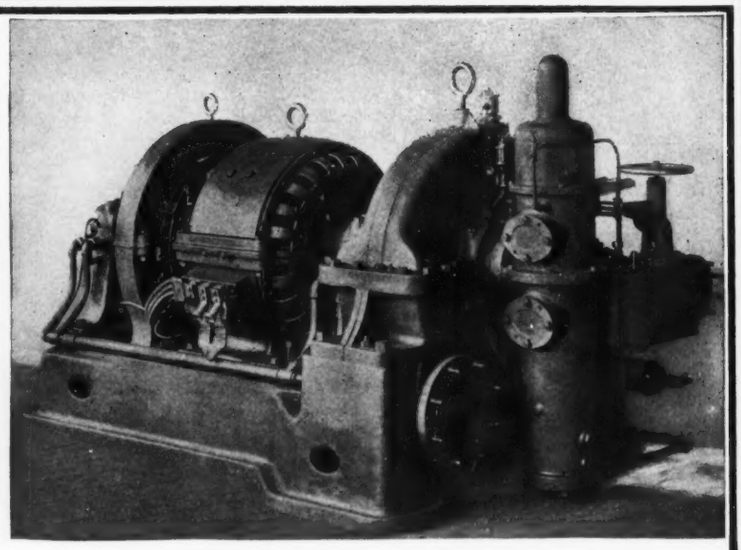

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These machines embody the qualities which have firmly established the large turbines as the standard prime movers of today. They are built complete at East Pittsburgh and carry our usual guarantee.

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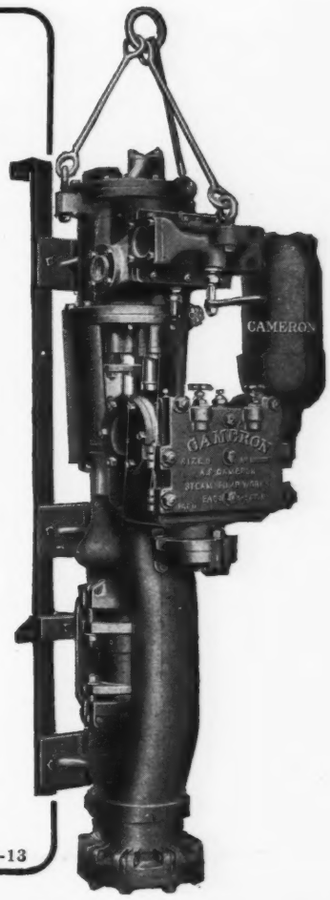
Vertical Plunger Sinking Pump

The Steam Valve Movement works without arms or levers. The Steam Mechanism consists of four stout pieces only, there is no outside Valve Gear. For these reasons you can run the Cameron Pump faster, without danger of breaking, than any other steam pump.



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A. S. Cameron Steam Pump Works
11 Broadway New York

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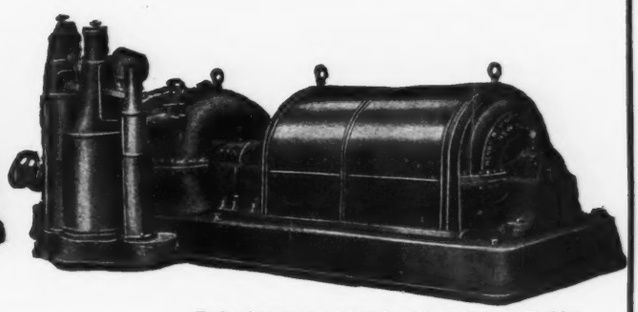
Turbine Driven and Motor Driven { **TURBO-BLOWERS and TURBO-COMPRESSORS**

For every pressure and capacity.

Motor Driven Turbo-Blower—Capacity 30,000 cu. ft. per min. 15 lbs. gage pressure.



Turbo-Compressor driven by Mixed Pressure Turbine. Capacity 10,000 cu. ft. per min. 100 lbs. gage pressure.

After careful investigation the Worthington Company have acquired the exclusive rights for the manufacture and sale on the American continent and in the Hawaiian and Philippine Islands, of the full line of Turbo Compressors and Blowers so successfully developed by Messrs. Pokorny & Wittekind, of Frankfort, a.m., Germany,—and are in position to build and supply Turbo Compressors and Blowers for all ranges in capacity and pressure ordinarily covered by reciprocating machines.

Purchasers may be assured that this line of Compressors has absolutely passed beyond the experimental stage. It has produced the highest economy ever attained and has thoroughly demonstrated that it is the most practical and reliable apparatus of its type now in the market.

Full information and estimates will be furnished promptly.

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Massachusetts Institute of Technology (1911) graduate, good experience, satisfactory credentials; interview in New York. Addres P. W. 475, Enginering and Mining Journal. t.f.

Mining engineer, technical graduate, experienced as mine and mill superintendent; engineer and construction engineer, open for engagement. Address H. J. R., Engineering and Mining Journal. July 19.

Technical graduate, three years' experience, gained in the States and Spanish America; best references; fluent Spanish; location immaterial. Address P. W. 467, Engineering and Mining Journal. June 28.

Mining and civil engineer, best of technical training, extensive experience in Latin American countries, fluent Spanish, desires position as engineer or superintendent. Address P. W. 470, care Engineering and Mining Journal. July 5.

Wanted—Position as mining superintendent or manager; applicant an all-around mining man of twenty years' experience; good mechanic, good executive, engineering sense. Address P. W. 456, care Engineering and Mining Journal. Aug. 2.

Graduate Michigan college of mines desires position as engineer or assistant to responsible consulting engineer; eight years' experience, good knowledge of Spanish; best credentials, character, ability, habits. Address P. W. 471, care Engineering and Mining Journal. June 28.

Mine superintendent open for engagement; experienced in lode and placer mining; exploration and development of copper, zinc, lead, gold, silver and pebble phosphate; testing of ground by diamond, churn and auger drills; engineer, draftsman and accountant. Address P. W. 477, care Engineering and Mining Journal. July 12.

Mine accountant and bookkeeper, age 32, desires position; eleven years' experience, thorough knowledge of mine bookkeeping, cost systems, pay rolls, and all duties connected with mining office. AddressP. W. 479, Engineering and Mining Journal. June 28.

Technical graduate, two years' experience in eastern copper refinery, 3 years in copper concentrator, five years in smelter, now leaving Mexico, seeks engagement as superintendent, metallurgist or research chemist; was seven years with one company and three years' superintendent of two thousand ton smelter. Address P. W. 478, Engineering and Mining Journal. June 28.

Mine manager and superintendent wants job; 20 years' western United States and Mexican experience; many years with two of world's largest companies. Address P. W. 480, Engineering and Mining Journal. July 5.

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Partial Inventory

9—18-ft. McDougall Roasters

3—Reverberatory Furnaces

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2—Stand Converting plant, with necessary blower engines and electrical equipment.

Bids will be received in part or whole for the above Smelting Plant.

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The Department of Marine and Fisheries has for sale seventeen compressors, steam 8", air 6" by 8" stroke, manufactured by the Clayton Air Compressor Works, New York.
The Compressors are absolutely new and complete in every respect.
Also, some other compressors steam 12", air 10" by 10" stroke.
All inquiries should be forwarded to the undersigned.

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Purchasing and Contract Agent. Ottawa, Can.

Air Compressor for Sale

One—Ingersoll-Rand Cross Compound Corliss and two-stage air compressor, steam cylinders 22 x 40 x 48, air cylinders 24 x 39 x 48. 4320 cubic feet of free air per minute, 100 pounds pressure.
One—12 x 22 x 24 Deane Jet Condenser.
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The above was in use about two years.

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STEAM OR POWER
FOR EVERY SERVICE
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The most durable pump for elevating
TAILINGS, SLIMES, BATTERY SANDS, ETC.
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Mfrs. of Turbine and Centrifugal Pumps, Steam Turbines, Condensing Apparatus, and Wainwright Feed Water Heaters.
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Hydraulic Turbines
To meet all requirements for heads from 5 to 600 feet. High efficiency maintained at all loads. Builders of the "Smith", "McCormick" and "Francis" Turbines. Water power accessories. **Write for Catalog J.**
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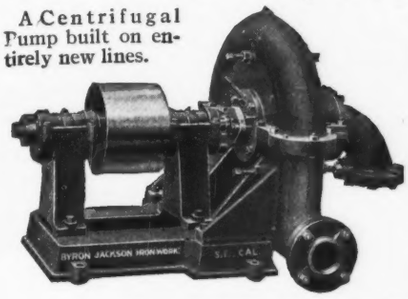
A New Jackson Split Slime Pump

A Centrifugal Pump built on entirely new lines.



It is designed primarily to reduce the "sand blast" effect of the sludge on the exposed parts so as to prolong their life and reduce cost of maintenance.

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BYRON JACKSON IRON WORKS, INC.
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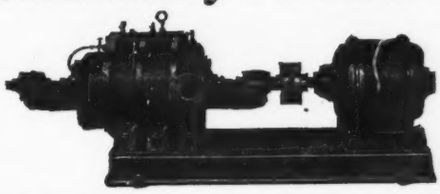
Absolutely No End Thrust



The Krogh Mine Pump.

Made so by its Automatic Hydraulic Balancing Device making it possible to operate it without set collars or thrust bearings. Let us send you bulletin giving full details.

Krogh Pump Mfg. Company, 149-157 Beale Street San Francisco, Cal.,

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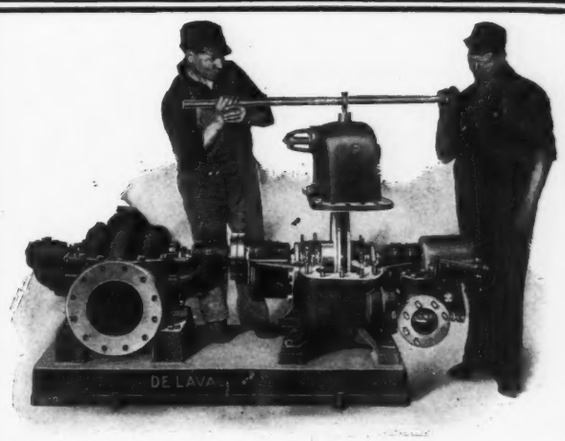

Ease of Renewal of the Wearing Parts of a De Laval Class "C" Turbine

ALL inspections, changes or repairs can be made without disturbing steam or exhaust connections, without requiring the use of a crane, without the necessity of sliding heavy parts out horizontally, without disassembling the wheels from the shaft or removing internal diaphragms from the casing, and without requiring the services of an expert. The DeLaval Class "C" Turbine is the only turbine on the market meeting all of these requirements.

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Cut Down Operating Costs.
Give Continuous, Even Stream.
Always Near the Suction Point.

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exclusively will be of material assistance to you in determining upon the equipment best suited to your individual needs.

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Works: Milwaukee, Wis. New York Office: 115 Broadway
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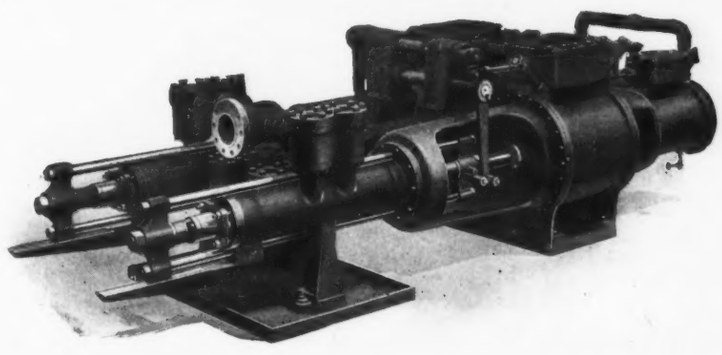

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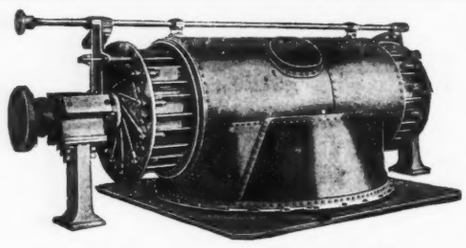

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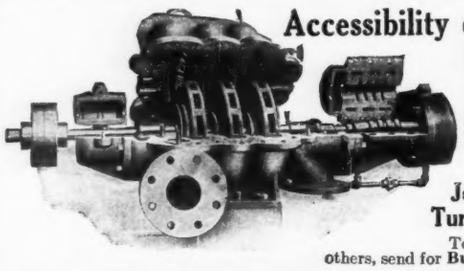

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To learn of the others, send for **Bulletin J36-16.**

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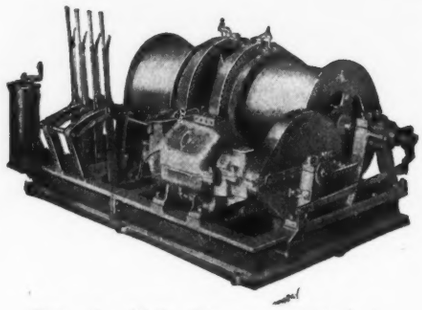

We build Steam Hoists up to 1,000 Horse Power.

We build Electric Hoists up to any size.

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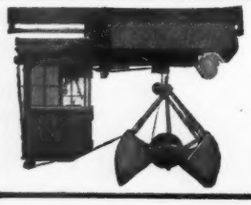

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DO your hoisting at less cost. For 26 years my hoisting machines have proved their superiority in mine work everywhere—reliable operation at a less cost per ton-foot lift. I make them even better now, and what is more, sell them lower than ever.

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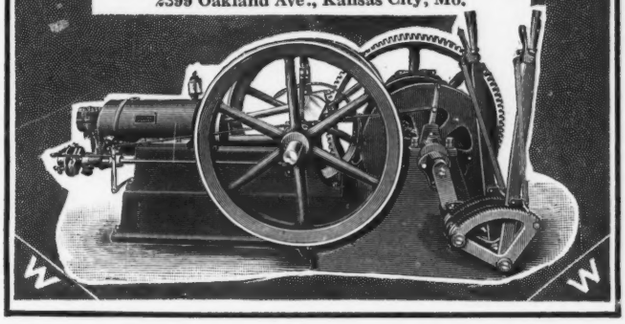

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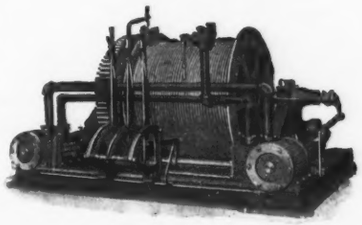

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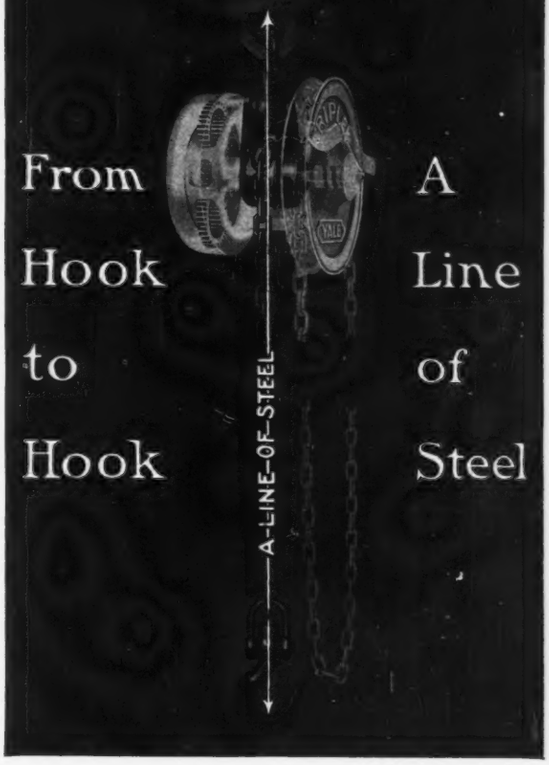

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Chain Blocks, Electric Hoists, Locks, Padlocks and Builders' Hardware.

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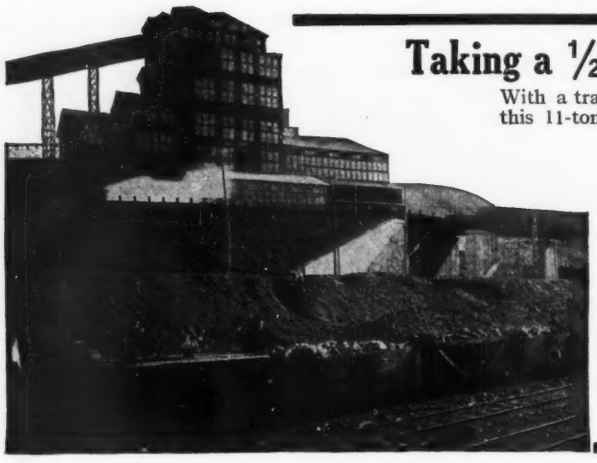

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With a tractive effort of 4,000 lbs. distributed among four 22-in. drivers, this 11-ton VULCAN Gasoline Locomotive drew 18 cars at an average speed of 6 miles an hour on a half per cent. grade at the Prospect Colliery of the Lehigh Valley Coal Company. The

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is the motor truck of the mining field, displacing the mine mule below and the steam "dinky" on surface and trestle.

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Mine Car Grease

Will cut down the wear on axles and wheels of your mine cars, and make easier work for your trammers. It is more durable and lasting than any other grease you can use—and therefore more economical. **The economies of Dixon's Graphite are explained in "Graphite As A Lubricant," No.42.**

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They are proportioned so that the severest strains and shocks are met with proper resistance.

No effort is spared in their construction. Every piece must be so accurately made as to fit not only the locomotive of which it is a part, but must fit every other locomotive of the same size and design.

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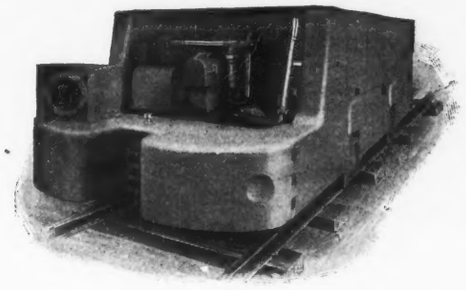
Northwestern Equipment Company, Seattle, Wash., and Portland, Oregon

Whitcomb Gasoline Mine Motors



In one mine, a Whitcomb Motor replaced 22 mules and 4 drivers, and increased the daily haulage by 100 tons.

If you are using mule haulage, every Whitcomb can save you from 1 to 2c. per ton on your daily output. The most economical and efficient haulage known.

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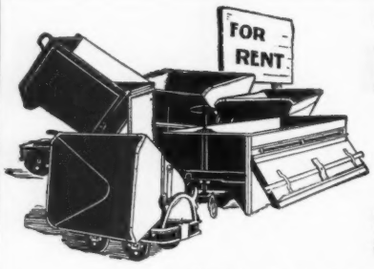

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Rails—12 to 70 lbs.
Switch Points, etc.

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Complete Industrial Railway Equipment.

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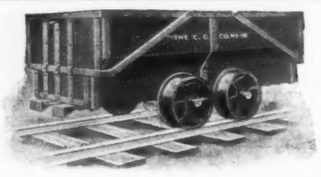

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That's the result we have achieved with our line of mine cars. Strong—light running. They will stand shocks that would wreck a wooden car. Their use means decreased haulage costs.

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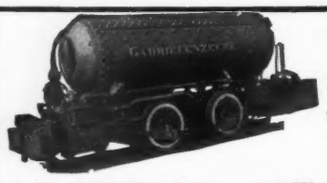

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All Gauges and for Every Variety of Service.
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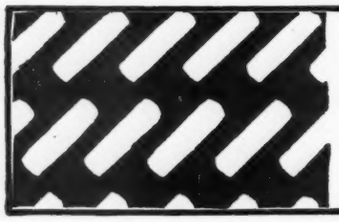

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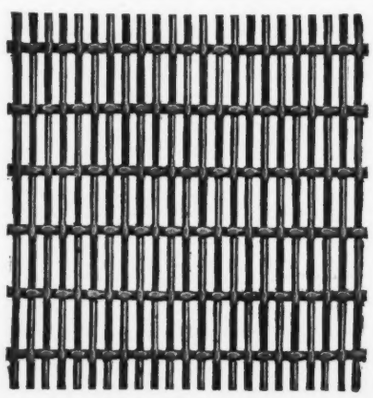

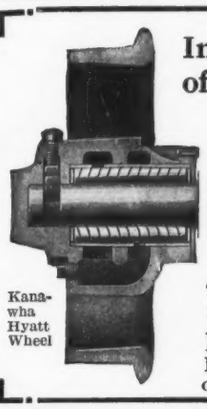

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HYATT FLEXIBLE ROLLER BEARINGS

The draw-bar pull is reduced 50%. Write for Bulletin 604E.

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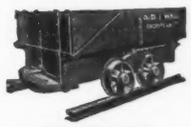

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"Trucks for cars now in use, or complete new cars, will be furnished equipped with the "Whitney" roller bearing wheels, with the floating automobile type of axle. Your cars will then run from six to twelve months with one greasing, will run with half the haulage power of the ordinary equipment. One man can push 12,000 lbs. on a level track. Cars can run through water or sand without damage to bearings. In use in 1000 mines. All wearing parts, axles, spindles, rollers, wheels, etc., fully guaranteed for one year from date of shipment. Largest ore mines now installing them."

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Compressed Air

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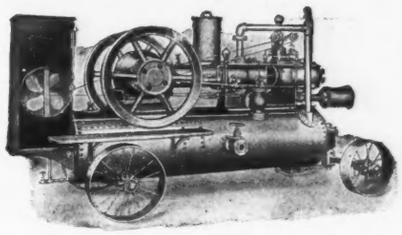

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300 sizes and styles—Steam, belt, gear, gasoline and direct motor drive.

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Automatic Selective Proportional Unloaders

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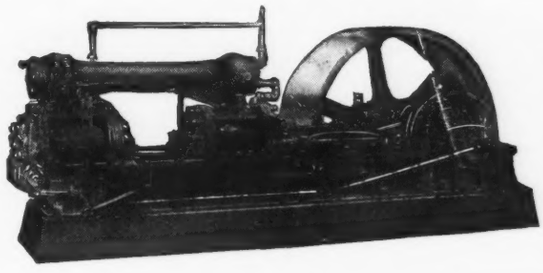

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These improvements mark a new era in compressor construction. They gain the instant and favorable attention of all skilled engineers. ¶ For the usual hackneyed claims of *economy*, *durability* and *efficiency*, let our forty years' experience be an assurance of adequate and discerning attention to every feature.

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Corliss Engines | Poppet Valve Engines | Uniflow Engines | Air Compressors | Hoisting Engines
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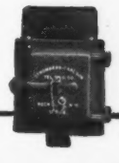

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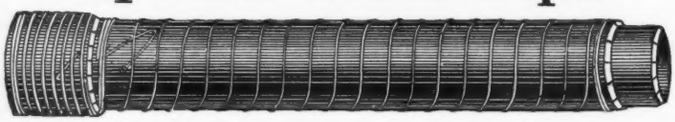

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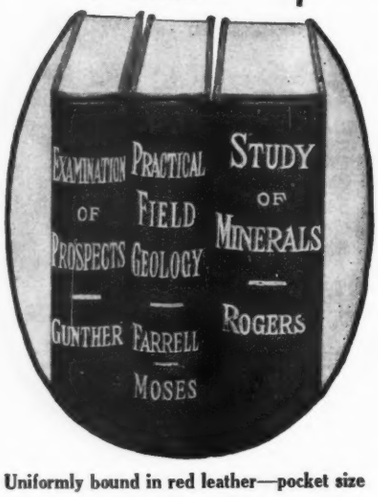

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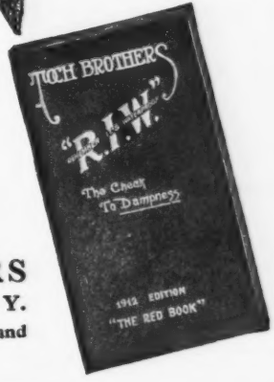

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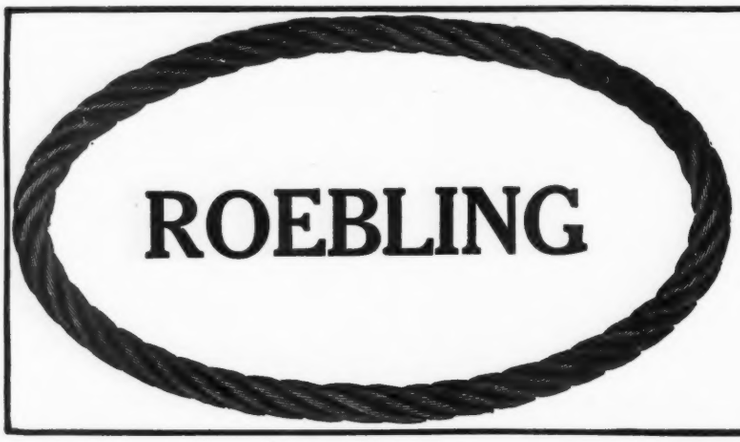

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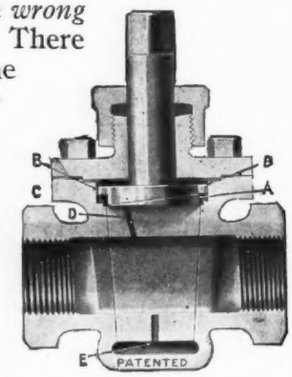

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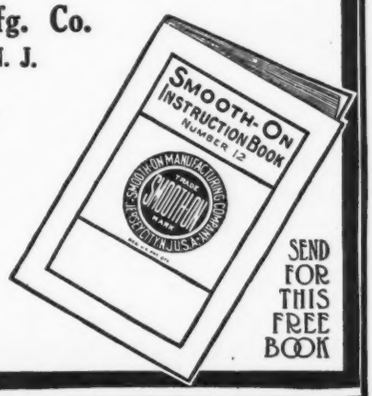

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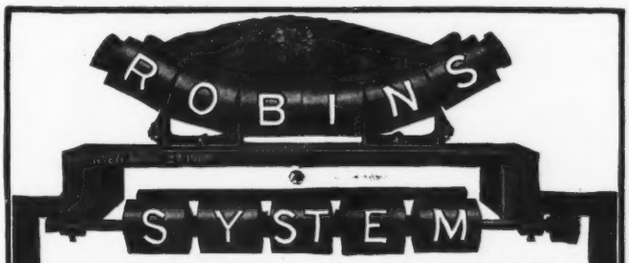

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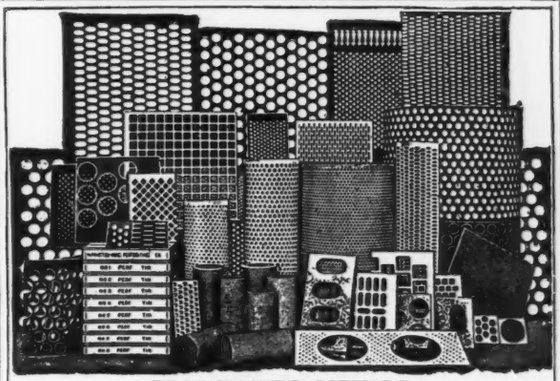

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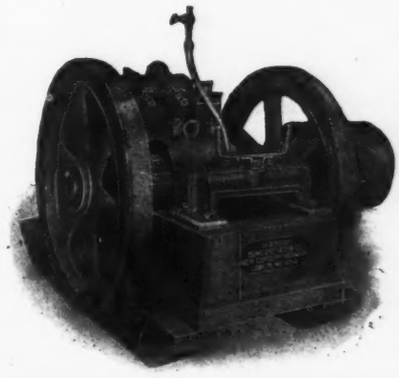

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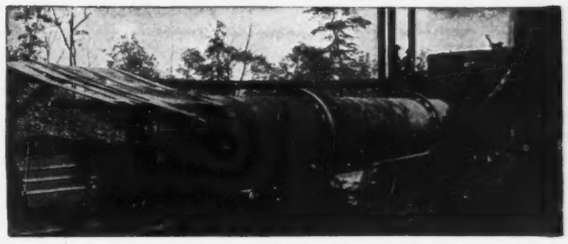

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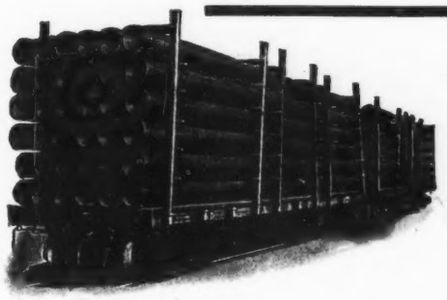

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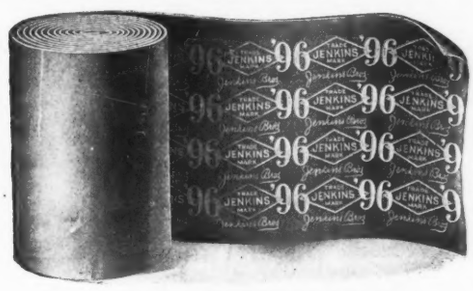

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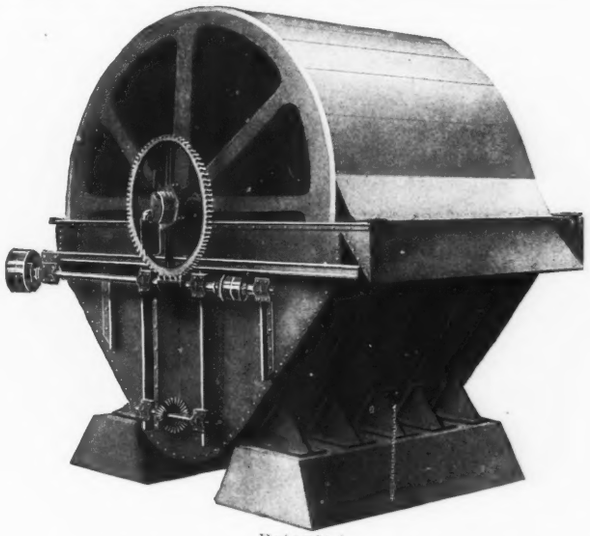

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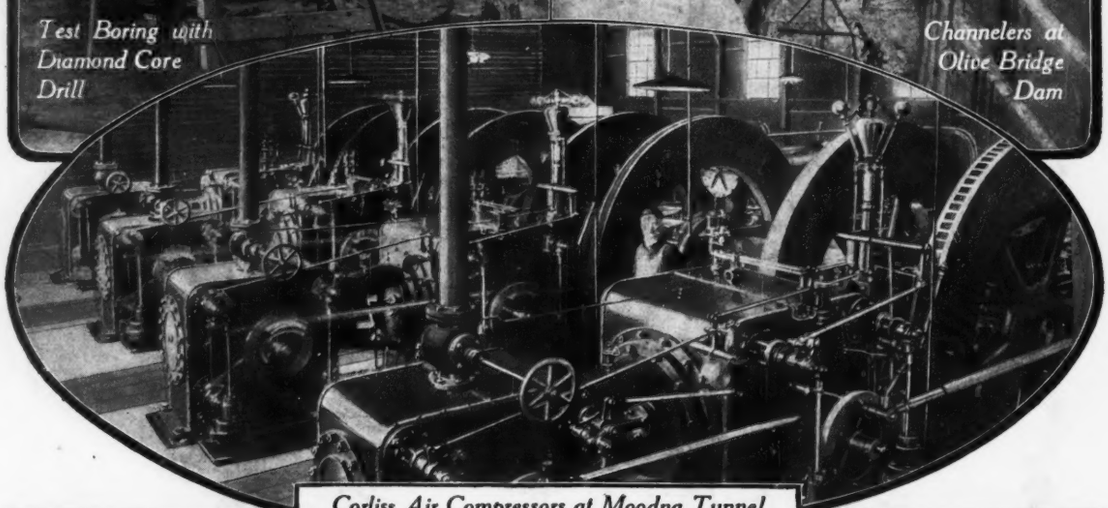

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